ANXIETY AS A DETERMINANT OF DIFFERENTIAL RESPONSIVITY TO REWARD AND PUNISHMENT

BY

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ANXIETY AS A DETERMINANT OF DIFFERENTIAL RESPONSIVITY TO REWARD AND PUNISHMENT

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PREFACE

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PREFACE

The present study grew out of a series of discussions, which took place in a seminar conducted by Dr. Eliot Rodnick, of research carried on by Dr. Norman Garmezy and several of his colleagues at the State University of Iowa. I am indebted to Dr. Garmezy for the motivation and technical help his research provided as well as for many helpful suggestions he has made as this study developed. I am grateful also for the help I received from Dr. Karl Zener, Dr. Louis Cohen and Dr. George Collier in sharpening the analysis and presentation of the present material. I am particularly grateful to Dr. Rodnick for his patience, his generous encouragement and expert guidance throughout the entire course of this study. To Dr. Janet Taylor I am indebted for her development of the anxiety scale which proved a very useful tool in the present study.

I am grateful to Mr. James Upchurch for his friendly and expert technical help in the construction of the experimental apparatus. For help in the preparation of mimeographed material my thanks go to Miss Mary Williams and Mrs. Lois Luessen.

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B. B.

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ANXIETY AS A DETERMINANT OF DIFFERENTIAL RESPONSIVITY TO REWARD AND PUNISHMENT

INTRODUCTION

Reward and punishment have been studied in the laboratory for their relative effects on learning processes (42, 43, 40) and on perceptual processes (31, 34); they have been studied in the classroom for their relative effects on learning and on modification of performance of various motor and mental tasks (3, 14, 15); they have been studied in relation to intellectual (14, 19, 20), age and sex factors (19, 20), and temperamental or personality factors (10, 22); and they have recently been studied in a clinical setting in connection with problems of psychopathology (12). The studies concerned with personality variables reflect a broadening concern with personality dynamics that has accompanied the recent rapid expansion of interest in the clinical area of psychology. They strongly suggest that there are differences related to personality factors in the effects and perhaps the effectiveness of rewarding and punishing incentive conditions.

It was to explore some of the implications of these studies and to extend the empirical data in this area that the present research was designed. To provide a framework for the discussion

which follows the major aspects of two studies will be outlined.

Garmezy (12) compared the performance of a group of schizophrenic and a group of normal subjects on an auditory discriminization task under reward and punishment conditions. Under a condition which he calls "reward only"[1] the height and the slope of the generalized response gradients for the two groups were insignificantly different. Under a "reward-punishment" condition, however, while the responses of the normal subjects resulted in a steeper response gradient, the gradient for the schizophrenic subjects was lower and flatter than under "reward only". In addition, the schizophrenic subjects showed a tendency to give the punished response progressively less frequently. These data show rather clearly that the avoidance of punishment is of sufficient importance to the schizophrenic subject that he becomes increasingly reluctant to risk making a response which has led to punishment even when such reluctance prevents his attaining the social reward of experimenter approval (for successful discrimination) and the material reward of candy or cigarettes.

Kelman (22) studied the effects of reward and punishment on

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1. Whenever the subject responded correctly to the standard stimulus a box lighted, reading RIGHT and a bar graph moved closer to the attainment of a candy or cigarette reward. For "reward-punishment" the condition was the same with the addition of a box reading WRONG which lighted when the subject indicated that the stimulus least like the standard was the standard. The bar graph also moved down a step with each WRONG response.

a response measure which he terms "suggestibility"[2] for groups of subjects who obtained high and low scores, respectively, on Guilford-Martin Inventory factors A (ascendancy), I (self confidence) and N (lack of nervous tenseness and irritability). He reports that the low scoring subjects (i.e., subjects who are retiring, who lack confidence and who are nervous and irritable) tend to be more suggestible following failure and less suggestible following success than do the high scorers. This suggests that the less secure, more anxious individuals tend to cling more strongly to a response they have learned is right and to avoid more strongly a response they have learned is wrong, than do the more secure individuals.

If we ask what common motivational element is to be found in schizophrenic individuals and those who achieve low scores on Guilford-Martin factors A, I and N which could logically mediate the exaggerated avoidance tendencies reported above, one likely answer would be anxiety. The role of anxiety in the production of a wide variety of behavior pathologies has been frequently described in the clinical literature (4, 8, 25, 37). In the laboratory, also, the phenomena of avoidance learning have required the conceptualization of anxiety as both an emotional response to threat or pain and as a drive with all of the

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[2] Suggestibility is defined operationally in this study by the amount to which a subject's judgments of autokinetic movement shift in a group session (2 people) in the direction of the judgments of a confederate of the experimenter.

energizing and reinforcing functions of a primary drive. (Miller (26), Mowrer (28)) The recognition of the importance of the drive aspects of anxiety has enabled several authors to make progress in the direction of integrating empirical observations of the laboratory with empirical (if less adequately quantified) observations of the clinic (27, 28, 35).

Recently studies exploring the functional properties of anxiety have appeared outside of the bounds of the animal laboratory and the clinical setting. The role of anxiety in normal behavior production and behavior modification is becoming the subject of an increasing number of studies.

Prominent among these is a series of studies emanating from the psychological laboratories of the State University of Iowa. For example, Taylor (38), Spence and Taylor (36), and Rosenbaum (33) report data which suggest that differences in the strength of defensive or avoidance response tendencies can be demonstrated for groups of normal subjects, differing with respect to the frequency and range of anxiety manifestations exhibited by each group. The more anxious individuals show the more vigorous defensive or avoidance tendencies. These researches and a related study by Hilgard, Jones and Kaplan (17) have employed as punishing stimuli, a sharp puff of air to the eyelid (38, 36, 17) and the anticipation of strong or weak electric shock or a buzzer (33). The response measures include the rate of acquisition and extinction of the conditioned eye-blink response (36, 38), a measure of discrimination conditioning, where one signal is

always followed by the air puff and another similar stimulus is never reinforced (17), and the stimulus generalization gradient of a voluntary motor response (33).

It will be noted that the last four studies mentioned have utilized physical pain or irritation (or the anticipation of these conditions) as incentives. In view of the importance of social factors and the stresses of interpersonal adjustments in the production of anxiety in human beings (4, 37, 25) it would seem desirable, in studying the differences in response patterns to reward and punishment that are associated with differences in anxiety level, to employ social or symbolic rewarding and punishing conditions. Of course "right" and "wrong", praise and reproof and induced or implied success and failure have been widely used as forms of incentives in psychological research and we have seen them effectively employed in the studies cited above.

Since it is primarily in the modification of voluntary or instrumental behavior (as opposed to autonomic or conditioned responses) that the greater part of our parental, pedagogical, commercial and clinical efforts are bent in the day to day processes of behavior modification in which we engage, it would seem most reasonable, in an investigation of the differential response-modifying effects of social reward and punishment, to choose a response measure that is primarily under voluntary control.

Statement of the Problem

Evidence contributed by the studies referred to above

suggests that in general, anxious individuals evidence stronger tendencies to avoid noxious stimulation than do less anxious individuals. It was to obtain empirical evidence relevant to two hypotheses suggested by this research that the present study was designed.

The first of these proposes to extend the evidence cited above to include social incentives, and to include reward as well as punishment with groups differing in degree of anxiety experienced. It may be stated explicitly in the following form: More anxious individuals will modify a simple pattern of voluntary responses to a greater extent in avoiding social punishment than will less anxious individuals. The other hypothesis which is suggested is: Anxious individuals will show more extensive response modification in the service of avoiding social punishment than in the service of attaining social reward.

It was felt desirable to select a task, as a medium for testing these hypotheses, which would provide a measure of the effects of reward and punishment in terms of a simple unambiguous voluntary motor response.

The simple two-category motor response of pushing or pulling a lever has the advantages of 1) minimizing indecision and eliminating the type of qualifications that can characterize verbal responses and 2) avoids the errors inherent in using an asymmetrical pair of responses, such as choosing between a motor response and no response.[3]

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[3] Newhall and Rodnick (30) report that differences in the

It was necessary that the incentive conditions (reward and punishment) induce a measurable modification in this response which could be primarily attributable to the effects of the incentives and not in any important way to learning. Zazlow (41), Klein et al. (23), Frenkel-Brunswik (11) and others have demonstrated the utility of a stimulus continuum of simple geometric figures or of more complex figures in studying rigidity and flexibility of discrimination relatively independently of learning phenomena. Therefore a simple discrimination task using circles differing in size seemed to meet these requirements of the present study adequately. It was reasoned that a stimulus continuum of this sort would provide an ambiguity condition within which a certain amount of response variability could take place apart from what might be attributable to learning.

Proshanski and Murphy (31) demonstrated that by associating reward with the presentation of longer lines and punishment with the presentation of shorter lines, a shift in judgments of the lengths of these lines is induced in the direction of increasing the mean of the judgments. It was reasoned therefore, that by rewarding responses in only one of two response categories, an

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force required to express a judgment, in the case of a differential intensity limen at least, will produce considerable differences in the limen scores obtained for different amounts of force. Garmezy (13) reports from his experience with schizophrenic subjects that when a two-category response consists of response and non-response rather than by two different motor movements, patients, at least, are apt to do nothing. And it may be presumed that some individuals might tend to make a motor reaction with every presentation of the stimulus conditions.

increase in the rewarded response could be induced. Likewise, the administration of punishment to responses in only one category was anticipated to induce a decrease in the frequency of that response and to induce a corresponding increase in the frequency of the other response.

Preliminary work using a task similar to the one outlined above demonstrated its feasibility for revealing changes in performance, when the simple discrimination task was modified by the introduction of rewarding and punishing conditions. This task was then considered an adequate tool for determining differences in the response-modifying effects of reward and punishment for individuals differing along a measurable personality variable.

Measuring a variable such as anxiety presents certain problems since the stimulus conditions which may cause its arousal are so numerous and so widely variable and since its presence can be observed only indirectly and through a very wide variety of responses and behavior sequences. It is probably impossible at present, to measure with any degree of accuracy what may be considered individual differences in anxiety level or vulnerability to threat. Since, however, anxiety manifests itself in a wide variety of involuntary changes in organ function and a variety of unpleasant feeling states it is possible to measure anxiety differences roughly in terms of the number, frequency and intensity with which an individual experiences these "anxiety symptoms," as they have come to be referred to in the clinic. Taylor (39) has developed an inventory type anxiety scale which

approaches the problem of measuring anxiety by this means. The capacity of this inventory to discriminate between high and low anxiety within general college populations is amply attested to. It was this scale, which is described in some detail in the following section, that was chosen for use in selecting the experimental groups of the present study.

CHAPTER II

The subjects

Two groups of 32 subjects each were selected from a population of 265 students enrolled in the undergraduate General Psychology course at Duke University. An anxiety scale, which is described in detail later, was administered to the student population indicated above and the two experimental groups were made up of most of the students whose scores on this anxiety scale fell within the upper and lower 20 percent of the distribution of scores. Each of these two groups was divided into a reward and a punishment group. Thus we have four groups of 16 subjects each. They will be referred to as LAR (low anxiety, reward), LAP (low anxiety, punishment), HAR (high anxiety, reward) and HAP (high anxiety, punishment).

The anxiety scale

The anxiety variable was defined operationally in this study by two ranges of scores on an anxiety scale developed by Taylor (39) at the State University of Iowa. The scale consists

of 200 items from the Minnesota Multiphasic Personality Inventory (MMPI) which were chosen in the following manner. Ninety statements were selected from the MMPI which were believed to describe manifestations of generalized anxiety. Items were excluded from this selection which describe symptoms which are thought of clinically as representing defenses against the experiencing of anxiety or which described anxiety provoking situations. Taylor chose only those which she felt described manifestations of generalized anxiety. These 90 items were submitted to the five members of the clinical staff at the University of Iowa with a statement of the criteria used in selecting them. They were embedded in 150 additional items selected at random from the remaining MMPI items. These five judges agreed 100 percent on 45 of the anxiety items and 80 percent on 20 or more of them. These 65 items were used in the construction of the anxiety scale. To disguise the purpose of the scale 135 items from among those uniformly judged as non-descriptive of anxiety were included in the final scale.

Administering this scale to 356 students enrolled in general psychology at the University of Iowa she obtained a distribution of scores (i.e., the number of so-called deviant responses to items constituting the anxiety scale) from 1 to 35 with the median at 14. Subjects scoring 7 and below or 25 and above represented the upper and lower 15 percent of the distribution. These scores served as cutoff points to define groups differing in anxiety level.

The same scale administered by the present experimenter to

265 Duke University General Psychology students yielded a distribution of scores which is almost identical with that of the Iowa group. Our low anxiety groups are drawn from those who scored below 8 on this scale. Because of midsemester scheduling difficulties, however, in order to obtain 32 subjects for the two high anxiety groups, it was necessary to use an upper cutoff point several points below the one used by Taylor. With two exceptions the low score for these two high anxiety groups is 23. One HAR subject scored 21 and one HAP subject scored 20.

As a check on the care with which the items were answered, a count was made of the total number of statements classified "undecided" and the number of anxiety items falling in this classification. Reasoning that by chance half of the undecided items would have been classified in the deviant direction if a decision had been reached about them, the criterion for membership in the low anxiety group was determined by the anxiety score plus one-half the anxiety items classified "undecided". This total had to be less than 8 for a subject to be included in the low anxiety group. By the same reasoning it would have been possible to include subjects in the high anxiety group who scored below twenty on the anxiety scale when the number of anxiety items marked "undecided" exceeded two. However, it was decided to use the stricter criterion for this group, simply their anxiety score.

Since the anxiety scale in the form in which it was used in this study included 8 items of MMPI "L" scale and 23 items of the MMPI "F" scale, a check of the responses to these items

was made in an effort to detect carelessness or a tendency to create a false impression on the part of any of the subjects. Only one of the subjects made as many as four deviant responses for the "L" scale items and only three made as many as four deviant responses for the "F" scale items. A majority of the subjects scored zero or one on the items of both of these scales. Since Meehl and Hathaway recommend an "L" score of 7 or above or an "F" score of 16 or above as invalidating scores, it was felt that scores of 4 or less were within acceptable limits. Therefore no one was excluded from membership in either the high or low anxiety groups on the basis of either of these scores.

Table I shows a summary of the anxiety scale scores of each of the four experimental groups. All figures in the table represent group means. The individual scores are to be found in Table XV in Appendix IV.

TABLE I

Type of Score	Groups			
	LAR +	LAP	HAR	HAP
Anxiety score	4.94	4.62	29.62	27.62
Total undecided (?)	7.00	6.00	11.19	6.19
Anxiety undecided (?)	1.05	1.05		
"L" score	.81	1.69	.25	.50
"F" score (deviant resp.)	.38	1.19	2.00	1.88

+ LAR = low anxiety reward, LAP = low anxiety punishment, HAR and HAP = high anxiety reward and punishment.

Membership in the reward and punishment subgroup was for the most part randomly determined. However, a preliminary study had shown that performance under conditions of reward and punishment varied importantly with performance during the initial "no information" discrimination series. Therefore an effort was made to equalize the means of the two high and the two low anxiety groups by assigning the last few subjects who achieved high scores during the initial "no information" series to the group which, up to that point, showed the lower mean. The degree of success which was achieved in matching the groups by this method will be seen in Table II on page 29.

Description of the experimental apparatus

The experimental task which was selected as fulfilling the requirements outlined in the preceding section was a visual size discrimination task. The stimuli consisted of eight circles. Two of the circles, the largest and the smallest, will hereafter be referred to as the standard circles, the six intermediate circles, as the test circles.

The task which the subject was to perform was simply to indicate, as each circle was presented, whether it looked more like the larger or more like the smaller standard circle. These circles were photographed, one circle per frame, on Eastman Micro-File film in an order which is indicated by the numbers on the left margins of the Data Sheet (see Appendix III). In determining the order of presentation for the stimulus circles an

effort was made to have each test circle follow each other test circle and itself twice during the series, for both the position immediately following and the position one step removed. This was to control for the contrast effect which occurs when stimuli are presented successively. The standard circles, in addition to appearing three times each at the beginning of the series, also appear an additional three times each distributed through the series.

Projected at nine and a half feet, as they were for this experiment, the circles appear, respectively, 7.00, 7.75, 7.86, 8.10, 8.28, 8.33, 8.50 and 9.33 millimeters in diameter or 33.48, 47.17, 48.52, 51.53, 53.85, 54.50, 56.75 and 68.37 square millimeters in area. These size relationships are presented graphically in figure 1a. The diameter and area measurements are converted to common scale units to facilitate comparison.[1] For a subject seated eleven feet from the projection area the circles subtend a visual arc of less than 1°40'. They appeared as black circles against a light field 21 x 17 inches in size. To minimize the formation of visual after-images the position of the stimulus on the light field varied randomly in position along the vertical axis. This served to make the task of comparative

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[1] The unequal intervals between successive circle sizes were not intentional but resulted from the use of instruments of inadequate precision in the construction of the stimulus material. It will be noted, however, that the subjects' judgments of the relative sizes of the stimulus circles corresponds closely to the physical size relationships between the circles, and therefore apparently do not introduce a serious source of bias.

judgments slightly more difficult than would have been the case if successive circles appeared in identical positions on the screen. Thus the range of ambiguity through which response variations could occur was widened slightly. It will be noted that the standard circles, the largest and the smallest, are considerably larger and smaller respectively than any of the six test circles are in relation to adjacent test circles. This was done both to insure that the standards were 100 percent distinguishable from each other for all subjects and to increase the range of ambiguity along the stimulus continuum without increasing the ambiguity of the task itself.

Each stimulus circle was exposed for one second. The click associated with resetting a Standard Electric Time Co. chronoscope served as a "ready" signal. Exposure of the succeeding circle followed this signal within a second. To interfere with the formation of anticipatory sets, the interval between the ready signal and exposure, as well as the interval between exposures, were varied slightly. The interexposure interval varied from about 3 to 5 seconds.

Exposure time was controlled by a plunger-operated Alfax shutter mounted in front of the 35 mm. projector that was used to present the stimuli. The action of the shutter opening closed a relay which started the chronoscope which was stopped by a movement of the subject's lever-type response switch in either direction. This response switch was a double-pole, double-throw spring-return Mallory lever switch which was

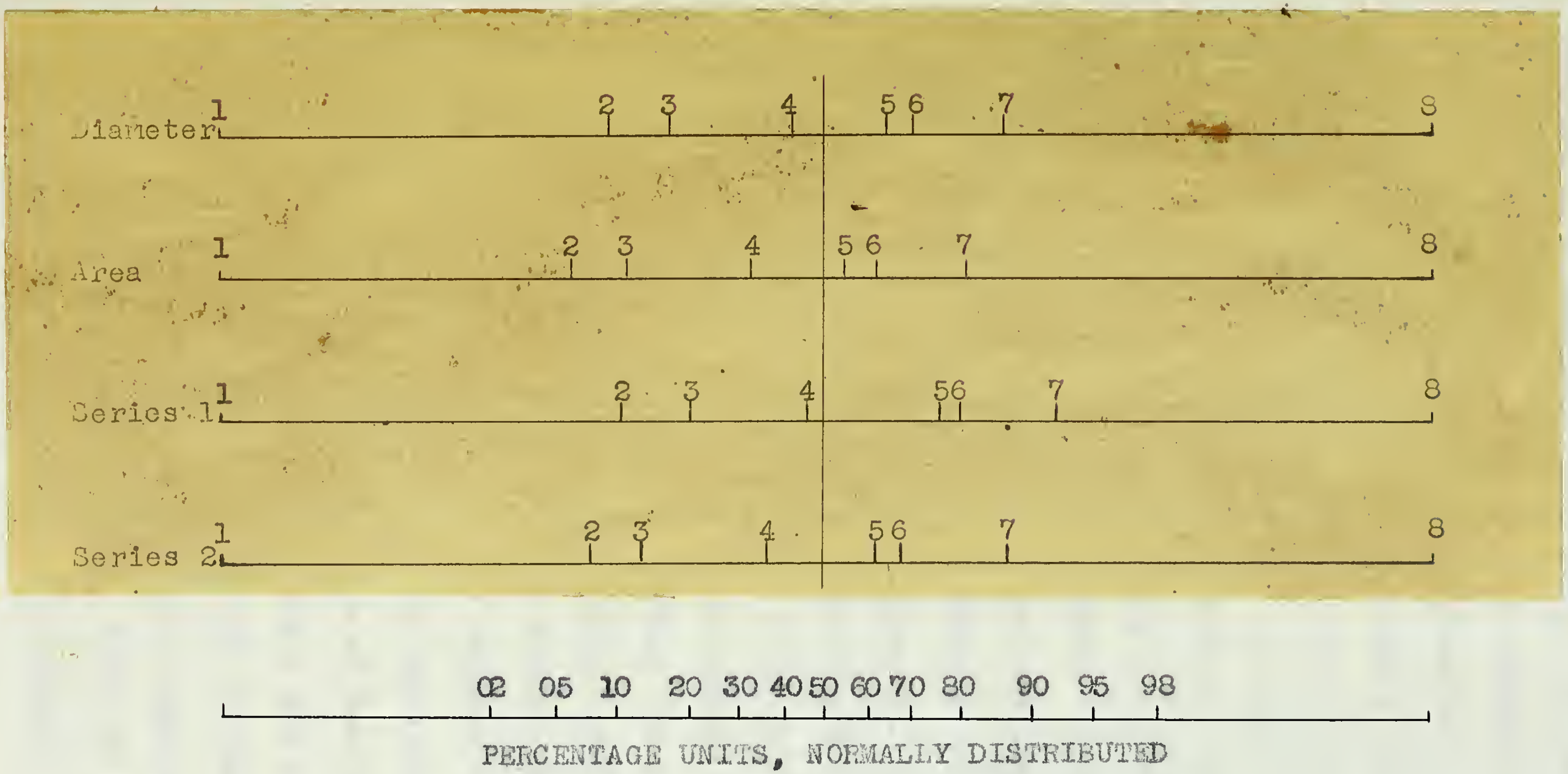

Figure 1a. The relative sizes of the eight stimulus circles presented in terms of 1) diameter, 2) area, 3) the proportion of larger responses made to each circle by all sixty-four experimental subjects during series one and 4) during series two.

mounted in a push-pull position at the end of a wooden arm in a small aluminum box. The subject sat so that his arm rested on a table while he operated the response lever. (See Fig. 1b for the layout of the experimental room.) His response was signalled to the experimenter by means of a pair of lights, one red and one white, mounted directly in front of the experimenter. Responses were recorded as indicated in Appendix II.

Each subject was seen during a single experimental session which lasted from 35 to 45 minutes. During this session the series of 84 stimulus circles was presented three times. During the first two presentations a subject judged each circle as being more like the larger or more like the smaller standard circle without receiving any information as to the correctness of his responses. These series will be referred to hereafter as the "no information series" or simply "series one" and "series two". An effort was made to equate the experimental groups on the basis of responses during these first two series. Also, the performance of each subject during these two series served as a base line against which to measure the changes in performance which occurred in the third (incentive) series.

Before the third series one of two signal boxes, similar to those described by Garmezy (12), was placed on a table before the subject. One of the boxes had the word RIGHT painted on a piece of transluscent plastic which was mounted behind the ground glass front of the box. When the box was illuminated the word RIGHT became visible to the subject. Similarly the other

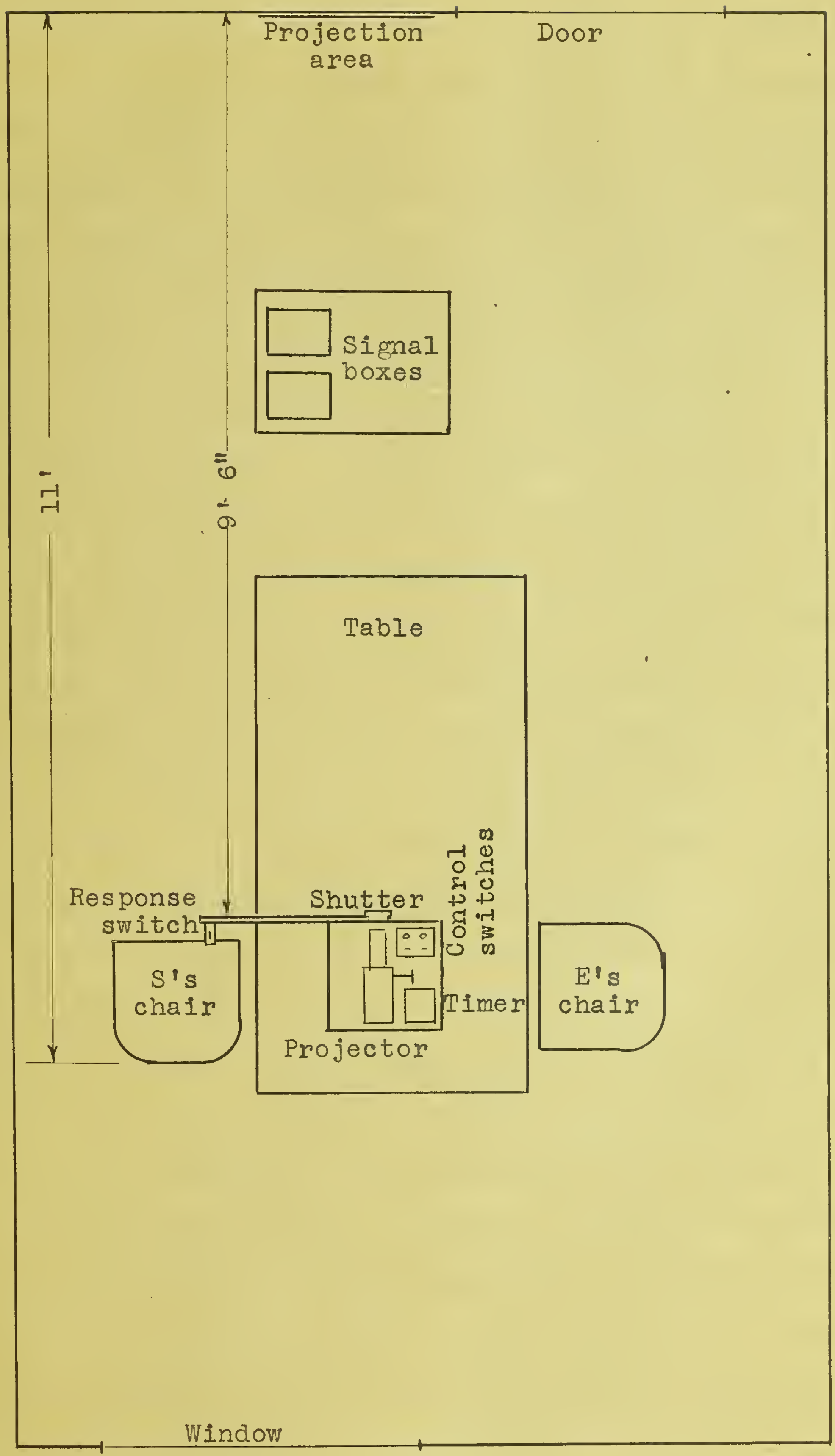

Figure 1b. Layout of the experimental room.

box illuminated the word WRONG. As indicated earlier with half of the experimental subjects the RIGHT signal was used, with half, the WRONG. The position of a pair of pre-selector switches, operated by the experimenter, determined whether or not the subject's response would light one of the signal boxes, which box would light and the direction of the subject's response which would light it. A relay was included in the circuit to keep the signal box on long enough for the subject to have no question that it had lighted. A wiring diagram of the circuits employed in the experimental apparatus is presented in Fig. 2.

In an effort to maximize the motivational or incentive aspects of these RIGHT and WRONG signals and at the same time to minimize their information giving aspects, the signals were made to operate by responses to only two of the six test circles. Thus the subject received no information about the adequacy of his responses for four of the circles. If the circles are numbered from one for the smallest through eight for the largest, as we have done (circles one and eight being the standard circles) then it was responses to circles five and six which operated the signals. Since there are three smaller circles (2, 3, and 4) and three larger circles (5, 6 and 7) in the test series, reward and punishment were administered for responses to two of the three larger circles. Whenever a subject in either of the two reward groups indicated that either circle 5 or 6 was smaller the WRONG box would light. Tendencies to repeat the rewarded response and to avoid repeating the punished response

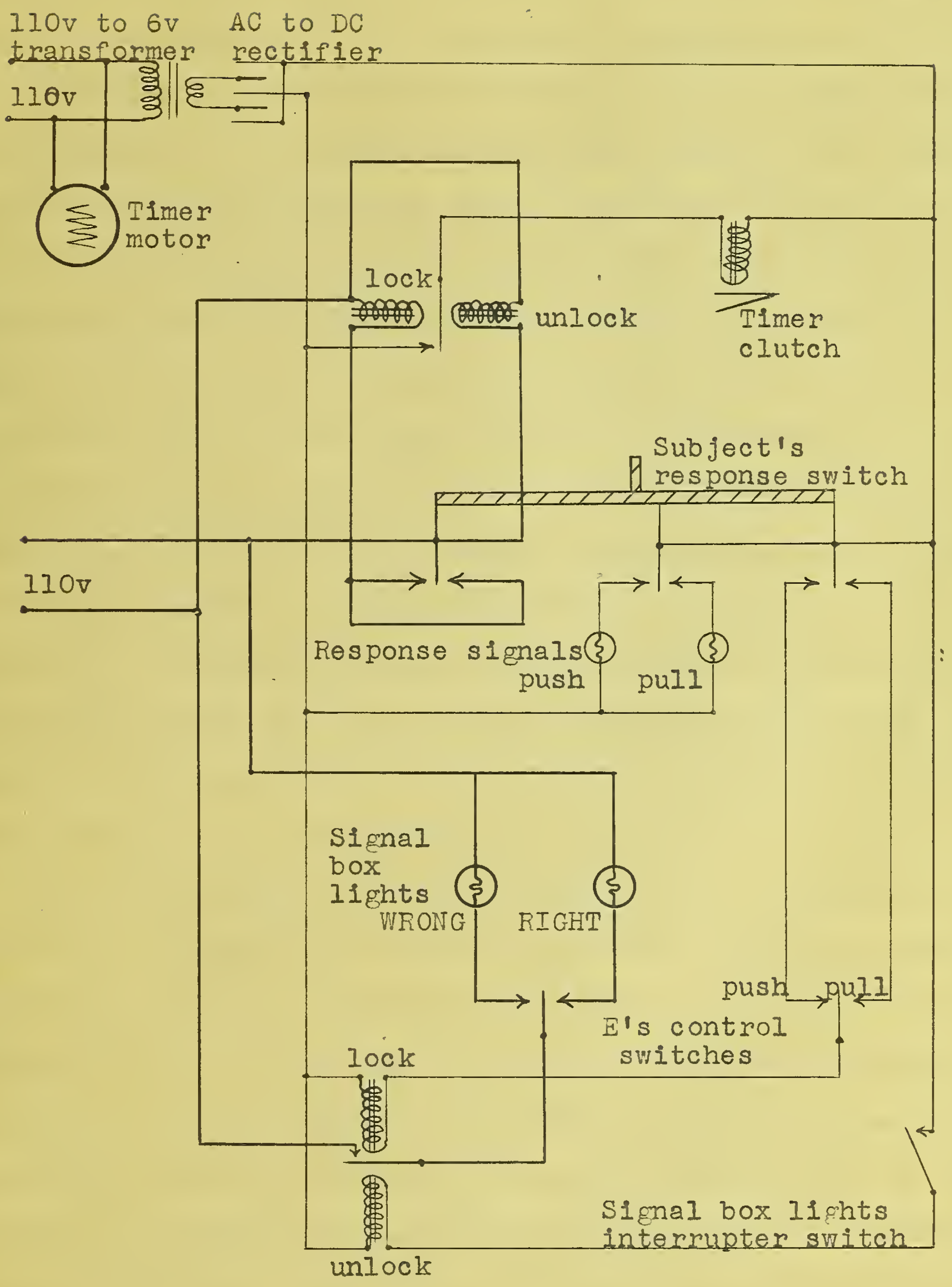

Figure 2. Wiring diagram.

could then be observed in increases in the number of a subject's responses that indicated a judgment of "larger".

The major response measure that was used in comparing the performances of the several experimental groups is one which is based on the total number of switch movements indicating a judgment of larger which were made by each subject during a given presentation of the stimulus series. Since there were six test circles each of which was presented twelve times during a single series the scores could range from zero to seventy-two. A score of twenty-five would indicate, then, that a subject had moved the response switch in the direction which indicated a judgment of "larger" twenty-five times during a presentation of the stimulus series. Although the two standard circles were presented six times each during each series, responses to these two circles were not included in the frequency scores by which the performance of the groups was compared.

The discrimination task was carried out in an 8'5" x 15' room with a window which provided a variable source of light. This source of variability was controlled to a certain extent, however, by 1) the presence of a louvred window screen which permitted no direct sunlight to enter the room during any experimental session, 2) keeping the window shade drawn, 3) maintaining a constant source of light from the 200 watt tungston overhead bulb which lighted the room and 4) random scheduling of subjects from each of the four experimental groups.

Procedure

The anxiety scale was administered to all students enrolled in the undergraduate General Psychology course in group form during regular quiz section periods. The subjects whose scores met the criteria for membership in either the high or low anxiety group were then asked to participate in the discrimination part of the experiment as partial fulfillment of the laboratory requirements of the course.

To maximize rapport and cooperation considerable flexibility was permitted subjects in making appointments. As a subject arrived for his appointment he was usually met outside the experimental room, greeted warmly and called by name, Mr. Jones or Miss Smith, etc. Preliminary to the discrimination task was a brief warm-up period during which E showed an interest in the subject's grade placement, major interests, home town, etc. and showed S the experimental apparatus and explained the functioning of its several parts. The subject was then seated before the response switch, shown the two standard circles and permitted to practice responding to these until he had met a criteria of three successive correct responses to each of the standards.

The full series of stimulus circles was then presented with instructions to the subject to judge each circle as to whether it looked more like the larger or more like the smaller standard. The subjects were alternately assigned one of the two response procedures. Half the group pushed the lever to indicate a judgment of larger, and pulled to indicate a judgment of smaller.

The other half of the subjects reversed this procedure. Upon completion of the stimulus series the subject was told that it had been a practice series and was engaged in conversation which was directed toward obtaining the subject's feelings, attitudes and ideas about the task and his performance of it. During this time the stimulus film strip was rewound, and after about 5 minutes the subject was told he would be shown the standards again several times and then would be tested on a series of circles again.

Following the second series the subject was again questioned about the task and his performance. The interval was extended to 7 or 8 minutes as the signal box was set up and instructions for the final series were given. The subjects in the two reward groups (LAR - HAR) were told that the RIGHT box would light only for a few of the circles which were most difficult to discriminate so that when it lighted it meant that they had made a difficult discrimination and responded correctly. The subjects in the punishment groups, on the other hand, were reminded that they had had a good deal of practice by now so that when they responded incorrectly for a few of the circles which they should now be able to discriminate (on the basis of how their classmates had done), the WRONG box would light up. The ambiguity of the instructions was calculated to minimize the learning and maximize the motivational aspects of the signals.

After the third series subjects were asked: 1) how they felt they had done--compared with the previous two series, 2)

which series they liked best, 3) how many different sized circles there seemed to be, 4) what changes in the situation, if any, were made by the introduction of the signal box, 5) whether it was easier to either push or pull the lever, 6) whether they had noted any tendency to call circles appearing high or low on the screen either large or small, 7) whether they had noted any changes in the order, proportion of larger to smaller circles or any other differences in the three series of circles. The session was closed by giving each student a brief exposition on psychophysical methods and measurements.

The detailed verbal instructions given each subject are recorded in Appendix II.

CHAPTER III

Analysis of Results

In order to test the hypotheses of this study concerning the differential effects of reward and punishment on the behavior of groups of subjects differing in anxiety experience, a comparison must first be made of the performance of the groups in the experimental task prior to the introduction of reward or punishment. The responses of the groups during series one and two provide the basis for such a comparison.[1] Thus, the F test for homogeneity of samples was made for each relevant pair of groups. These tests are summarized in Table II. It will be noted that for series one, none of the differences are so great that they must be considered significantly different from chance variations. The two scores which approach significance for series two may be seen to be contributed to largely by the very

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[1] The scores to which the following discussion has reference are scores based on the total number of response-switch movements which indicate judgments of "larger" for a given presentation of the series of stimulus circles.

small variance of group LAP. Since no systematic change was made in the experimental variables during this session, this unusually small variance may be considered a chance occurrence which does not seriously distort the empirical relationships discussed below.

The data for series three are also presented in Table II for purposes of comparison. The magnitude of the variance for the several experimental groups in series three may be seen to be systematically related to the group mean scores (see Table III). The group with the highest mean (HAP) has the least variance and this relationship changes progressively until the group with the lowest mean (HAR) has the largest variance. As the scores approach the maximum, then, the variance decreases. A similar relationship does not exist, however, between the means and the variances of the several experimental groups in series one and two. Therefore this relationship may be considered to have resulted in large measure from the effects of reward and punishment on the scores in series three.

Since, from their performance in the first discrimination series, the groups may be considered to have been drawn from the same population with respect to the response measure which is under consideration, an analysis of variance may be undertaken to determine the extent to which the experimental variables contribute to the observed variance. The resultsof an analysis of variance of the scores of each group for each series are presented in Table IV.

TABLE II

THE HOMOGENIETY OF ALL RELEVANT PAIRS OF EXPERIMENTAL GROUPS AS DETERMINED BY THE "F" TEST[1]. EACH VARIANCE ESTIMATE IS BASED ON THE RESPONSES OF SIXTEEN SUBJECTS

	Series 1		Series 2		Series 3	
GROUP	Estimate of Variance	F	Estimate of Variance	F	Estimate of Variance	F
LAR	108.80	1.624	130.93	2.515++	79.37	1.030
LAP	66.99		52.06		81.77	
HAR	71.05	1.368	108.61	1.423	145.85	2.316+
HAP	97.18		154.42		62.97	
LAR-HAR		1.531		1.206		1.838
LAP-HAP		1.451		2.966++		1.299

++These "F" values represent a $P < .10 > .05$.
+ This "F" value represents a $P < .20 > .10$.
1. The test used is the one suggested by Edwards (6, pp. 164-5) For 15-15 degrees of freedom $F_{.10}=2.41$, (estimate of $F_{.05}=3.00$)

TABLE III

THE MEANS, STANDARD DEVIATIONS, AND STANDARD ERROR OF THE MEANS FOR THE FREQUENCY OF LARGER JUDGMENTS FOR THE SERIES OF TEST CIRCLES. EACH SCORE IS BASED ON THE RESPONSES OF SIXTEEN SUBJECTS

	Series 1			Series 2			Series 3		
GROUP	Mean	σ	σ_m	Mean	σ	σ_m	Mean	σ	σ_m
LAR	41.50	10.0	2.61	33.50	11.08	2.86	45.69	8.63	2.23
LAP	36.06	7.92	2.05	32.25	6.99	1.81	43.19	8.76	2.26
HAR	40.12	8.23	2.13	33.62	10.09	2.61	41.38	11.66	3.01
HAP	36.12	9.54	2.47	35.19	12.03	3.11	50.19	7.68	1.98

It will be seen that there are two F scores that approach significance ($P < .05$). The first of these, which appears in the first series, reflects the fact that the mean scores for both the reward groups were higher than for the two punishment groups. Reference to the data for series one presented in Table III and in figures 3, 4 and 5 will make this clear. This bias, although unfortunate, does not detract importantly from the significance of the interaction variance for the third series, due to the following consideration. It may be seen from the data for series 3 in Table III that the high mean for the HAP group and low means for the HAR and LAP groups in series three contribute importantly to the significance of the interaction variance. The higher means for the two reward groups in series one would be expected to contribute to higher means for these groups in the third series also. It is the HAP group, however, which has the highest mean for series three, and although one reward group (LAR) has the second highest mean score for series three, the other (HAR) has the lowest.

Since it is evident that an interaction of the anxiety and the reward-punishment variables significantly influences the scores in series three we are justified in testing the significance of differences between relevant pairs of groups by a device such as the *t* test. Table V summarizes the results of testing, by the *t* method, the significance of the differences between means of all relevant pairs of groups. Because the interaction variance is significant in series three it is

TABLE IV

ANALYSIS OF VARIANCE OF FREQUENCY SCORES BASED ON THE NUMBER OF LARGER RESPONSES FOR THE SIXTEEN SUBJECTS IN EACH OF THE FOUR EXPERIMENTAL GROUPS

Series 1 — No information

	Sum of Squares	Degrees of Freedom	Variance Estimate	Obtain. F	F_{05}	F_{01}
Total	5,689.61	63				
Between grps.	380.92	3	126.97	1.435	2.76	4.13
Within grps.	5,308.69	60	88.48			
Anxiety	8.26	1	8.36	--		
Reward-punish.	365.76	1	365.76	4.032*	4.00	7.08
Interaction	6.90	1	6.90	--		

Series 2 -- No information

	Sum of Squares	Degrees of Freedom	Variance Estimate	Obtain. F
Total	6,942.35	63		
Between grps.	69.16	3	23.05	--
Within grps.	6,873.19	60	114.55	--
Anxiety	37.13	1	37.13	--
Reward-punish.	0.00	1	0.00	--
Interaction	32.03	1	32.03	--

Series 3 -- Reward -Punishment

	Sum of Squares	Degrees of Freedom	Variance Estimate	Obtain. F	F_{05}	F_{01}
Total	6,252.23	63				
Between grps.	700.16	3	233.39	2.522	2.76	4.13
Within grps.	5,552.07	60	92.58			
Anxiety	28.88	1	28.80			
Reward-punish.	159.38	1	159.38	1.722	4.00	7.08
Interaction	511.90	1	511.90	5.523*	4.00	7.08

* These F values represent a $P < .05 > .01$

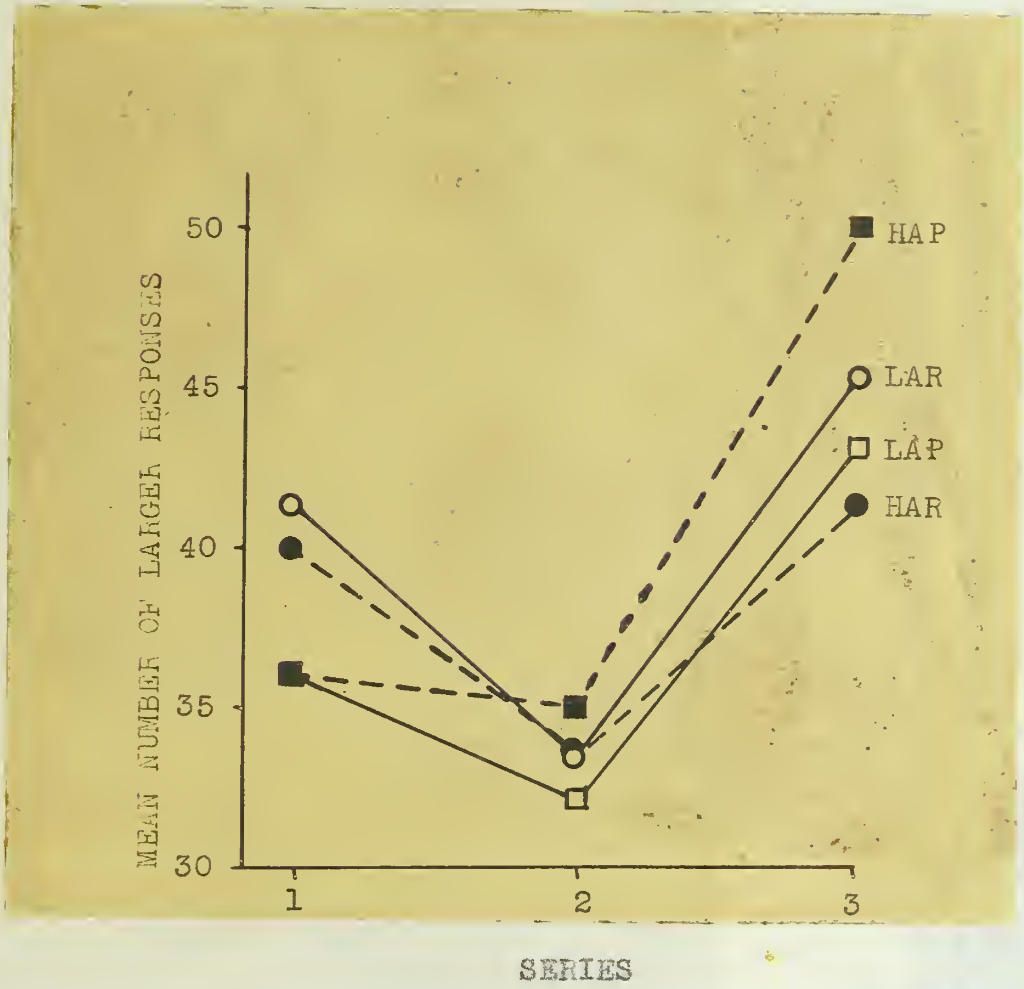

Figure 3. Mean number of larger responses for the four experimental groups during each of the three experimental series.

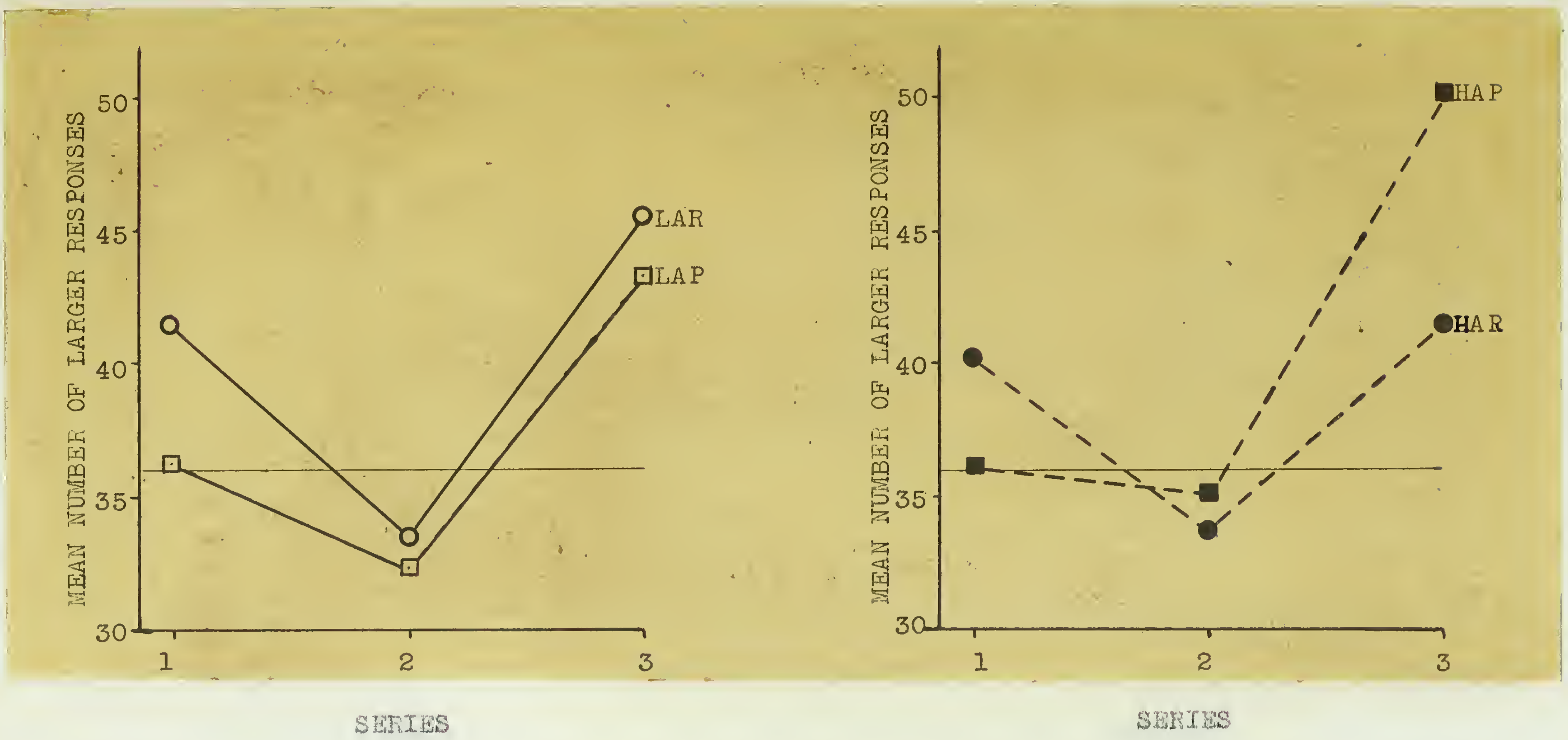

Figure 4. Mean number of larger responses for the four experimental groups during each of the three experimental series compared on the basis of anxiety level.

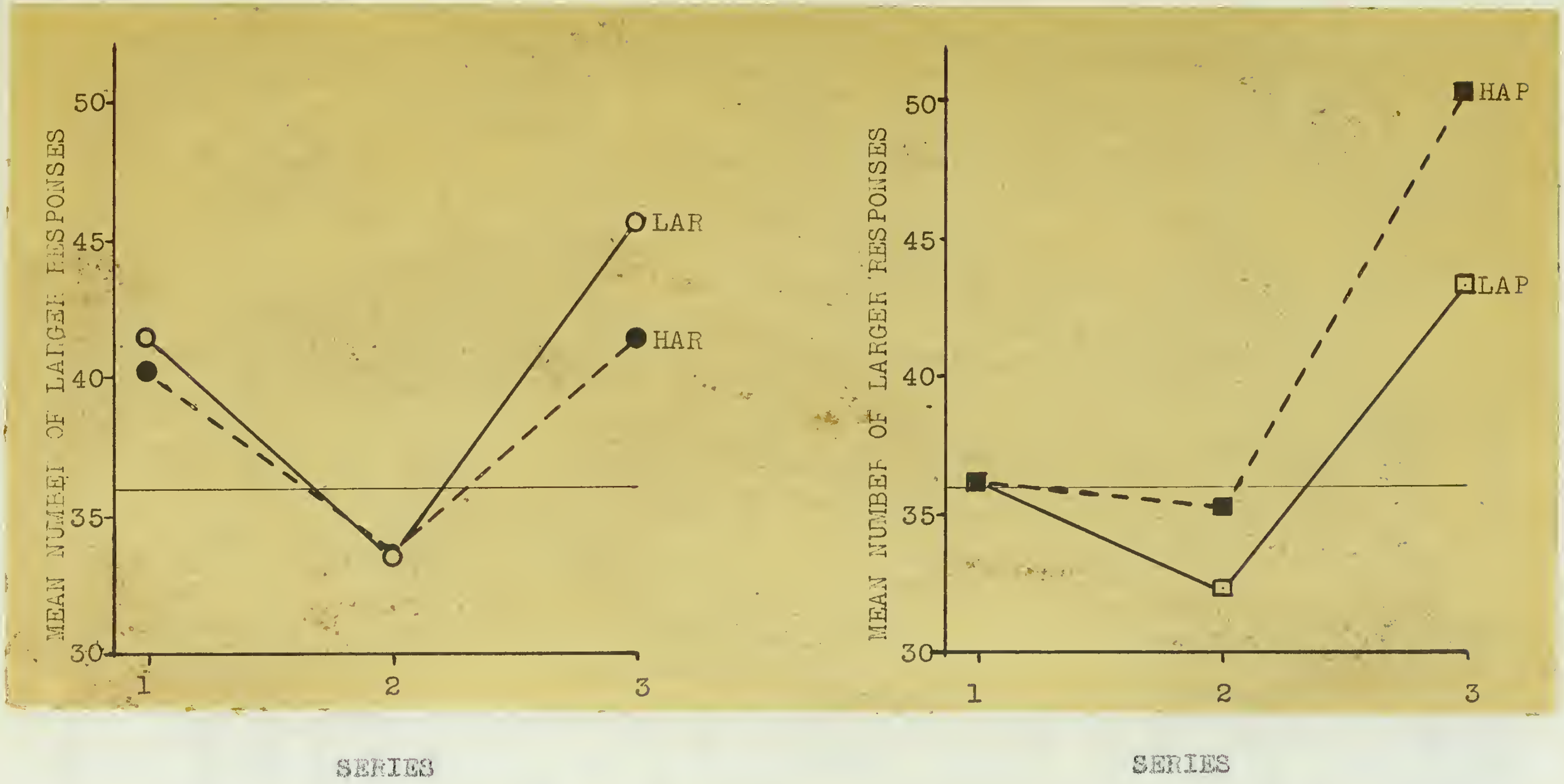

Figure 5. Mean number of larger responses for the four experimental groups during each of the three experimental series compared on the basis of reward and punishment.

legitimate to consider the group samples obtained in this series as independent samples and the method suggested by Edwards (6, pages 150 and 170, formula 48) may be employed to obtain t. It will be seen that the null hypothesis may be rejected at the 1 percent criterion for comparisons of group HAP with both HAR and LAP. Since the differences between mean scores of these two pairs of groups, i.e., HAR-HAP and LAP-HAP, is exceedingly small during the first two "control" series, the amount of difference which is observed in series three can be attributed in large measure to the interaction effects of high anxiety and punishment. Thus the two major hypotheses of this research are supported by these two significant differences for they show that one high anxiety group avoided punishment to a considerably greater extent than the other high anxiety group sought reward and also the high anxiety subjects avoided punishment to a greater extent than did the low anxiety subjects.

It may be argued that a measure involving the change in the performance of each individual from the control series (1 and 2) to the experimental series (3) might give a better estimate of the effects of reward and punishment on the performance of subjects differing in anxiety experience than will be reflected in a measure based simply on group means and standard deviations for the separate series. A difference measure of this sort was used therefore and was analyzed for differences between groups.[1]

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[1] A measure based on the difference between the performance

TABLE V

THE SIGNIFICANCE OF DIFFERENCES BETWEEN GROUP MEANS USING THE t TEST. SCORES ARE BASED ON THE NUMBER OF LARGER RESPONSES PER SERIES OF SIXTEEN SUBJECTS IN EACH GROUP

Series 1 - No information

GROUP	M	σ_m	σ_{m_D}	D_m	t
LAR	41.50	2.61	3.32	5.44	1.638
LAP	36.06	2.05			
HAR	37.75	2.13	3.31	1.63	.492
HAP	36.12	2.47			
LAR-HAR			3.37	3.75	1.113
LAP-HAP			3.11	.06	.019

Series 2 - No information

GROUP	M	σ_m	σ_{m_D}	D_m	t
LAR	33.50	2.86	3.39	1.25	.369
LAP	32.25	1.81			
HAR	33.62	2.61	4.06	1.57	.387
HAP	35.19	3.11			
LAR-HAR			3.87	.12	.031
LAP-HAP			3.60	2.94	.817

Series 3 - Reward-Punishment

GROUP	M	σ_m	σ_{m_D}	D_m	t
LAR	45.69	2.23	3.12	2.50	.801
LAP	43.19	2.26			
HAR	41.38	3.01	3.60	8.81	2.447**
HAP	50.19	1.98			
LAR-HAR			3.75	4.31	1.149
LAP-HAP			3.00	7.00	2.333*

** This *t* represents a difference with a $P < .0125$

* This *t* represents a difference with a $P < .025 > .0125$

This data is presented in Table VI. The relationships between scores obtained by this method differ slightly in degree from those which emerged in the analysis reported above. The difference between the HAR and HAP groups, for example, is accentuated somewhat to a _t_ which is well beyond the .01 level of confidence, while the difference between the LAP and HAP groups diminishes to a _t_ which is significant just at the .05 level. The small discrepancies that occur between these two methods of determining differences between the experimental groups is of course accounted for by the different relationships which exist between the scores for series three and scores for series one and two.

There is an additional factor which adds to the meaningfulness of the differences in performance that have been observed, particularly those which set the HAP group apart from the other groups. Consideration must be made of the fact that the strength of the tendency for response scores to be increased during the reward-punishment series is importantly related to the scores received during series one and two. The lower the score in series two, for example, the greater is the amount of increase in score which is possible for series three, for the maximum attainable score is only 72. Also the individual who

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in series three and the pooled performances of series one and two was considered preferable to a simple subtraction of series two scores from series three scores because of the heterogeneity of variance between groups LAP and HAP and between LAP and LAR which appeared in series two. Represented mathematically this score was:

$$\text{Score for series 3} - \frac{\text{Scores for series 1 and 2.}}{2}$$

TABLE VI

T TESTS OF THE SIGNIFICANCE OF DIFFERENCES BETWEEN GROUPS BASED ON SCORES DERIVED FROM THE NUMBER OF LARGER RESPONSES OF EACH INDIVIDUAL FOR

$$\text{Series 3} - \frac{\text{Series 1} + \text{Series 2}}{2}$$

GROUP	M	σ_m	σ_{m_D}	D_m	t*	P
LAR	8.19	1.97	3.05	.84	.275	-
LAP	9.03	2.33				
HAR	4.50	1.56	2.73	10.03	3.674	.0125
HAP	14.53	2.24				
LAR-HAR			2.51	3.69	1.470	-
LAP-HAP			3.13	5.50	1.757	.05

* for 30 df $t_{.05} = 2.042$, $t_{.01} = 2.750$ for the single tail test.

attained a high score in series one and a considerably lower score in series two might well be expected to return to or exceed his score for series one when influenced by the incentive conditions of series three. Table VII below was drawn up to illustrate this point and to provide evidence that the greater increase in score for group HAP as compared with group LAP is perhaps even more significant than the *t* test reported earlier would suggest. This table presents simply a count of the number of people in each group during each series who indicated that fewer than half of the circles were larger. The *amount* of the differences in scores which corresponds to the relative number of people that the numbers in the cells of this table represent are reflected in the mean raw scores presented in Table III and in figures 3, 4 and 5. It will be noted that for series two and three the same relationships exist between the mean scores of the four groups as are indicated by the number of people reported in this table.

TABLE VII

NUMBER OF PEOPLE MAKING FEWER THAN THIRTY-SIX LARGER RESPONSES PER SERIES

Group	Series 1	Series 2	Series 3
LAR	7	10	2
LAP	6	12	3
HAR	5	10	4
HAP	9	7	0

It can be seen that for groups LAR, LAP, and HAR the number of people scoring below the mean, increases from series one to series two, and doubles for the LAP group. At the same time this number decreases for the HAP group. There is an opportunity, then, for more members of the LAP group to show a greater increase in scores than exists for the HAP group. As we have seen, however, it is the HAP group which shows the greatest increase in score.

It may be shown that the differences in the amount of change in response frequencies which have been demonstrated to exist between the various groups for series three, do not result simply from the number of reinforcements of the incentive signals. This fact is revealed by a comparison of the amount of change in response frequencies for each group and the number of reinforcements of the incentive signals each received. Table VIII was drawn up to present the data relevant to such a comparison. It shows the mean number of reinforcements of the incentive signals for each group and the mean amount of change in response frequencies.

TABLE VIII

Group	Mean No. Reinforcements	Mean Response Change
LAR	20.31	8.19
HAR	17.69	4.50
LAP	5.25	9.03
HAP	2.94	14.53

It will be seen that the HAR group shows only about half as much change in response frequencies as group LAR, even though it received about nine-tenths as many reinforcements of the RIGHT signal. The HAP group on the other hand shows more than a third more change in response frequencies and only about half as many reinforcements of the WRONG signal as are shown by the LAP group. These relationships point up the marked sensitivity of the high anxiety subjects to punishment and also show their relatively diminished responsivity to reward.

It has been suggested that the different relationships which exist between the amount of increase in number of larger responses and the number of reinforcements of the incentive signals may be due to differences in the incentive values of these signals for the various groups. If this is so, then one might expect that the group for which a signal had the greatest incentive value would show a greater increase in number of larger responses earlier in the discrimination series than a group for which the incentive value of a signal was low.

To see if this actually occurred, a count was made of the number of larger responses the subjects of each group made during each quarter of each discrimination series. The results of this count are presented in Table IX. A graphic representation of these data is to be found in Figure 6a. It will be seen that with two exceptions the curves of the number of larger responses for successive quarters of series one and two show a slight downward trend. An explanation of this slight downward

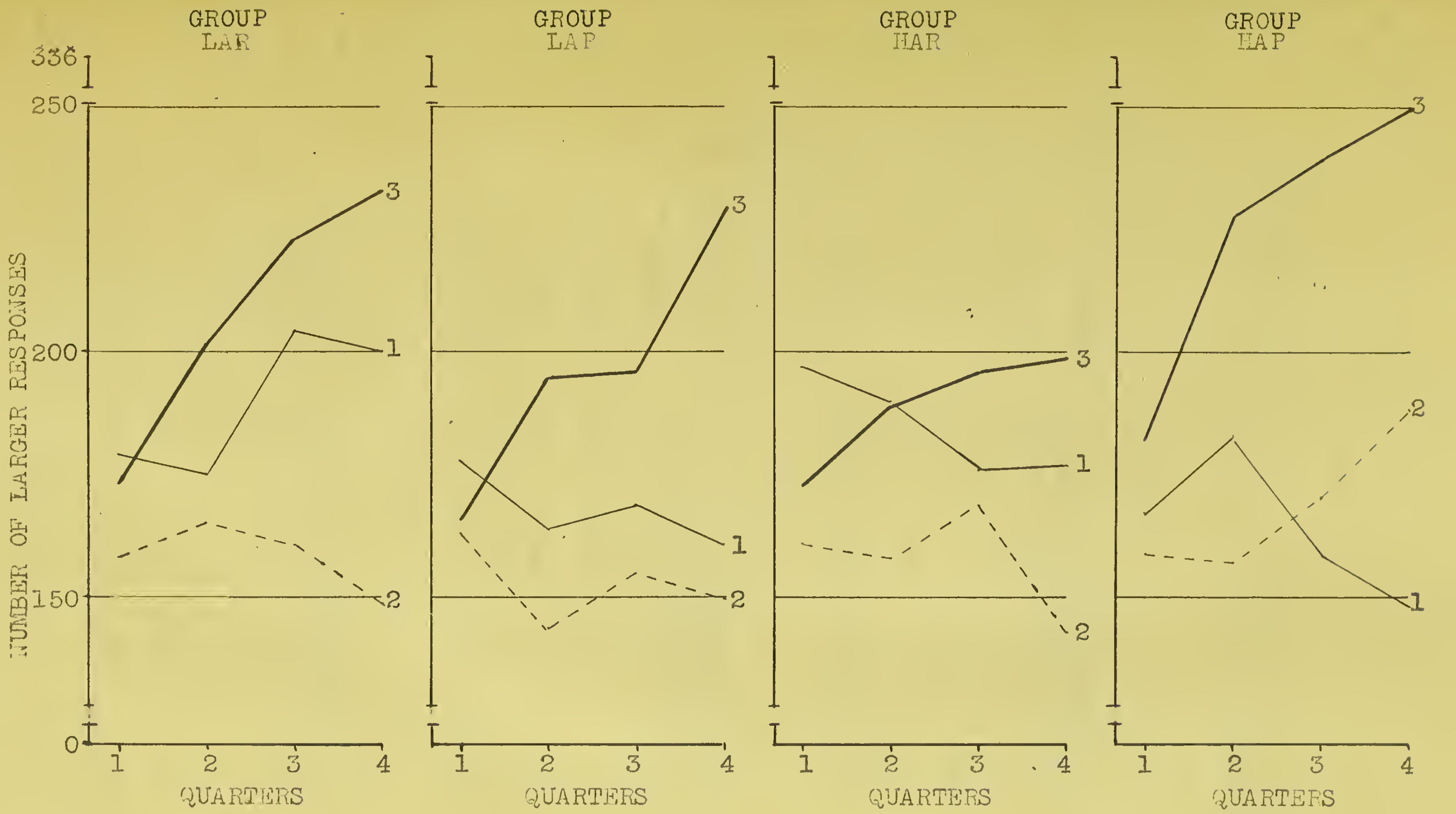

Figure 6a. Mean number of larger responses for successive quarters of the three discrimination series, for each of the four experimental groups.

TABLE IX

THE MEAN NUMBER OF LARGER RESPONSES FOR SUCCESSIVE QUARTERS OF THE THREE DISCRIMINATION SERIES, FOR EACH OF THE FOUR EXPERIMENTAL GROUPS.

Series 1

GROUP	QUARTERS			
	1	2	3	4
LAR	179	175	204	200
LAP	178	164	169	161
HAR	197	190	176	177
HAP	159	157	170	188

Series 2

GROUP	QUARTERS			
	1	2	3	4
LAR	158	165	161	149
LAP	163	144	155	150
HAR	161	158	169	143
HAP	167	183	159	148

Series 3

GROUP	QUARTERS			
	1	2	3	4
LAR	173	201	223	233
LAP	166	195	196	229
HAR	173	189	196	199
HAP	182	227	239	249

trend will be discussed shortly. For the moment it is sufficient to note that this trend is reversed in series three for all groups. The RIGHT and WRONG incentive signals may be seen to have induced a progressive increase in the number of larger responses for each group. The amount of this induced increase is, however, different for different groups.

As was expected the greatest increase in number of larger responses appears earliest for the HAP group, the group which received the fewest number of reinforcements of the WRONG signal. In other words, the fact that a considerably greater proportion of the increase in number of larger responses occurred during the first two quarters for the HAP group strengthens the contention that for the high anxiety subjects incentive value of punishment is greater than the incentive value of reward. In addition, the incentive value of punishment is greater for the high anxiety subjects than for the low.

The flatter curve for the HAR group lends support to the inference drawn from the data presented in Table VIII that the reward signal had reduced effectiveness for the high anxiety subjects. On the other hand, the similarity of the curves for the two low anxiety groups supports the evidence presented earlier which suggests that the incentive value of the RIGHT and WRONG signals is approximately equal for the low anxiety subjects.

To turn for a moment from a consideration of the differential effects of the incentive conditions on the several

experimental groups, it will be observed in Table III and in Figures 3, 4 and 5 that there is a drop in the number of larger responses from series one to series two for all four of the experimental groups. The mean number of larger responses for all sixty-four subjects during series one is 37.86 ± 2.63, while for series two the mean drops to 33.64 ± 2.60. For at least a partial explanation of this reduction in the number of larger responses we may turn to Figure 1a.

This figure was constructed in the following manner. Measurements of the diameters of the eight stimulus circles were plotted on a scale of millimeter units. The area relationships between the circles were similarly plotted. In addition the proportion of times each circle was judged larger by all sixty-four subjects was plotted separately for series one and two. Since circle number one was never judged larger it may stand for 0 percent while circle number eight which was always judged larger stands for 100 percent. The plot of these percentages was made according to their distribution along a normal distribution, for the frequency of judgments in a discrimination task of the sort used in the present experiment approximate an ogival function more closely than they do a straight line function. An ogival distribution may be converted to a straight line distribution by converting equal percentage units to normal distribution units as we have done.

To facilitate comparison of the diameter, the area and the response-determined relationships between the circles, the scales

on which each of these determinations was plotted were reduced to equal length, circles one and eight serving as the limiting points for each scale. This reduction was accomplished by the simple expedient of rotating the original scales until the points at which circles one and eight were plotted were perpendicular to the ends of lines of equal length. The points representing plots of the other circles could then be transferred to the new scale without distorting the relationships between them by simply dropping a perpendicular from each to the new scale line.

It will be seen that in series one the subjects tended to overestimate the sizes of all circles. In series two, on the other hand, the points indicating the proportion of larger judgments for each circle size fall between the positions which they occupy on the diameter and the area scales. Although a majority of subjects who were able to verbalize the method by which they made their judgments stated or implied that it was the area of the circle which had determined their judgments, some implied that their judgments were based on diameter comparisons. This suggests that the lower mean number of larger responses (Figs. 3, 4 and 5) and the lower scale positions of the test circles (Fig. 1a) for series two reflect improved judgment of the relative circle sizes. This also would account for the trend noted in Fig. 6a for the number of larger responses to fall off slightly during successive quarters of series one and two for all four of the experimental groups.

In Fig. 3 it will be seen that the mean number of larger

responses drops more rapidly for the low anxiety than for the high anxiety groups. Fig. 6b, which was constructed in the same manner as Fig. 1a, indicates the relative number of larger responses per circle for the two low anxiety groups and for the two high anxiety groups in series one and two. It will be seen that the unnumbered vertical bars which indicate the relative positions of the circles for series two are farther to the left of the numbered bars in the top line than in the bottom. This indicates that the low anxiety groups shift their judgments to a somewhat greater extent in the direction of greater accuracy than do the high anxiety subjects.

This difference in the amount of improvement in the judgment of the circle sizes for groups differing in degree of anxiety experienced is perhaps not unrelated to data reported by Rodnick, Rubin and Freeman (32). In making a number of physiological measures on two groups of NYA Camp youths who differed in personality adjustment they noted that two EEG measures which had been quite comparable for the two groups on the first day of testing became significantly different for the two groups on the second day of testing. The nature of these differences led these researchers to conclude that they reflected differences in adaptation to the experimental setting for the two groups--the less well adjusted group showing the least amount of adaptation. It is possible that the greater improvement in judgments of the circle sizes for our low anxiety groups reflects a similar advantage in adaptation to the experimental task.

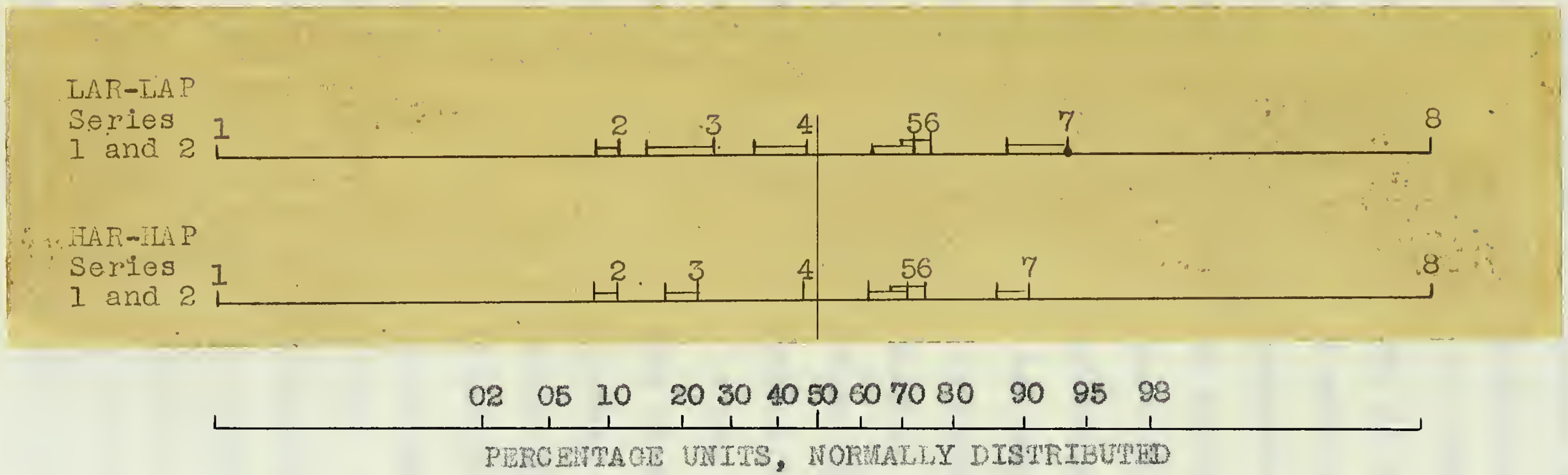

Figure 6b. The proportion of larger responses made to each circle during series one and series two for 1) groups LAR and LAP combined and 2) groups HAR and HAP combined. The vertical bars with the numbers above them represent the relationships between the circles as determined by the judgments for series one. The unnumbered bars to the left of these represent the relationships for series two. Note: For circle 4 in the bottom line the bars for the two series coincide.

There is another measure of performance which distinguishes between the high and the low anxiety groups that may also be related to a phenomenon of differential adaptation. The measure to which we have reference is one which attempts to reflect the extent to which subjects were able to distinguish between the various test circles irrespective of how closely their judgments approximated the relative physical sizes of the several circles. A measure of this sort was felt desirable in order to give maximum weight to the discrimination performance of each individual irrespective of whether he judged more of the circles to be smaller or more of them to be larger.

A plot was made therefore for each individual of the number of times he called each test circle larger. The plots were made on normal distribution paper, the ordinate representing the relative physical sizes of the six test circles and the abscissa representing the frequency of larger responses per circle transposed into normal distribution units. The reason for this transposition has been given above (discussion of Figure 1a). This conversion of an ogival relationship into a straight line relationship permitted us to draw a straight line through the points on the frequency plot. The slope of this line could then be interpreted as reflecting the adequacy with which a subject discriminated between the various test circles. The steeper the slope of the line the greater was the discrimination between circles. In order to convert the relative steepness of these slopes into numerical values the length of the line which fell

between the fifty and the eighty-four per cent points of the abscissa was projected onto a scale of millimeter units. A smaller number represented a steeper slope, for as the slope grew flatter a longer segment of it fell between the fifty and the eighty-four percent points.

The mean values of these measures of discrimination are summarized by groups in Table X and in Figures 7 and 8. In Figure 7 the data is represented simply in terms of the millimeter units of slope, the means for each group during each series being shown. The same data are represented in terms of the actual angles of slope in Figure 8. It will be seen that the two low anxiety groups show a slight overall improvement in discrimination from series one to series three while the two high anxiety groups show progressively poorer discrimination. Table X reveals that by series three the differences between the discrimination performance of the two low anxiety groups considered together and the two high anxiety groups considered together approaches significance.

Ordinarily the use of RIGHT and WRONG signals to indicate the correctness or incorrectness of responses provides not only incentive value but information also. It was expected, therefore, that these signals might contribute to improved discrimination even though the experimental task was designed to maximize the incentive aspects and to minimize the information-giving aspects of the signals. The data presented in Table X and in Figures 7 and 8 reveal that the signals gave little, if any,

TABLE X

SUMMARY OF DISCRIMINATION SCORES BASED ON A VISUALLY-DETERMINED MEASURE OF SLOPE (SEE TEXT FOR METHOD USED IN OBTAINING THESE VALUES.)

Series 1

GROUP	Mean	σ	σ_{m_D}	D_m	t	Confidence level
LAR	21.50	9.30	2.95	1.88	.64	----
LAP	19.31	6.66				
HAR	20.88	7.31	2.95	.59	.20	----
HAP	21.38	8.73				
LAR-HAR			3.05	.31	.102	----
LAP-HAP			2.84	2.16	.761	----

Series 2

GROUP	Mean	σ	σ_{m_D}	D_m	t	Confidence level
LAR	16.56	7.01	2.667	3.00	1.125	$P < .30 > .20$
LAP	19.56	7.56				
HAR	20.60	7.69	2.861	1.43	.500	----
HAP	22.03	8.01				
LAR-HAR			2.690	4.04	1.502	$P < .20 > .10$
LAP-HAP			2.840	2.47	.870	----

Series 3

GROUP	Mean	σ	σ_{m_D}	D_m	t	Confidence level
LAR	18.34	9.28	2.93	.44	.150	----
LAP	18.78	6.52				
HAR	22.94	7.36	3.069	.47	.153	----
HAP	23.41	9.31				
LAR-HAR			3.05	4.60	1.508	$P < .10 > .05$
LAP-HAP			2.938	4.63	1.576	$P < .10 > .05$
LAR+LAP	18.56	8.02	2.078	4.62	2.223*	$P < .05 > .02$
HAR+HAP	23.18	8.34				

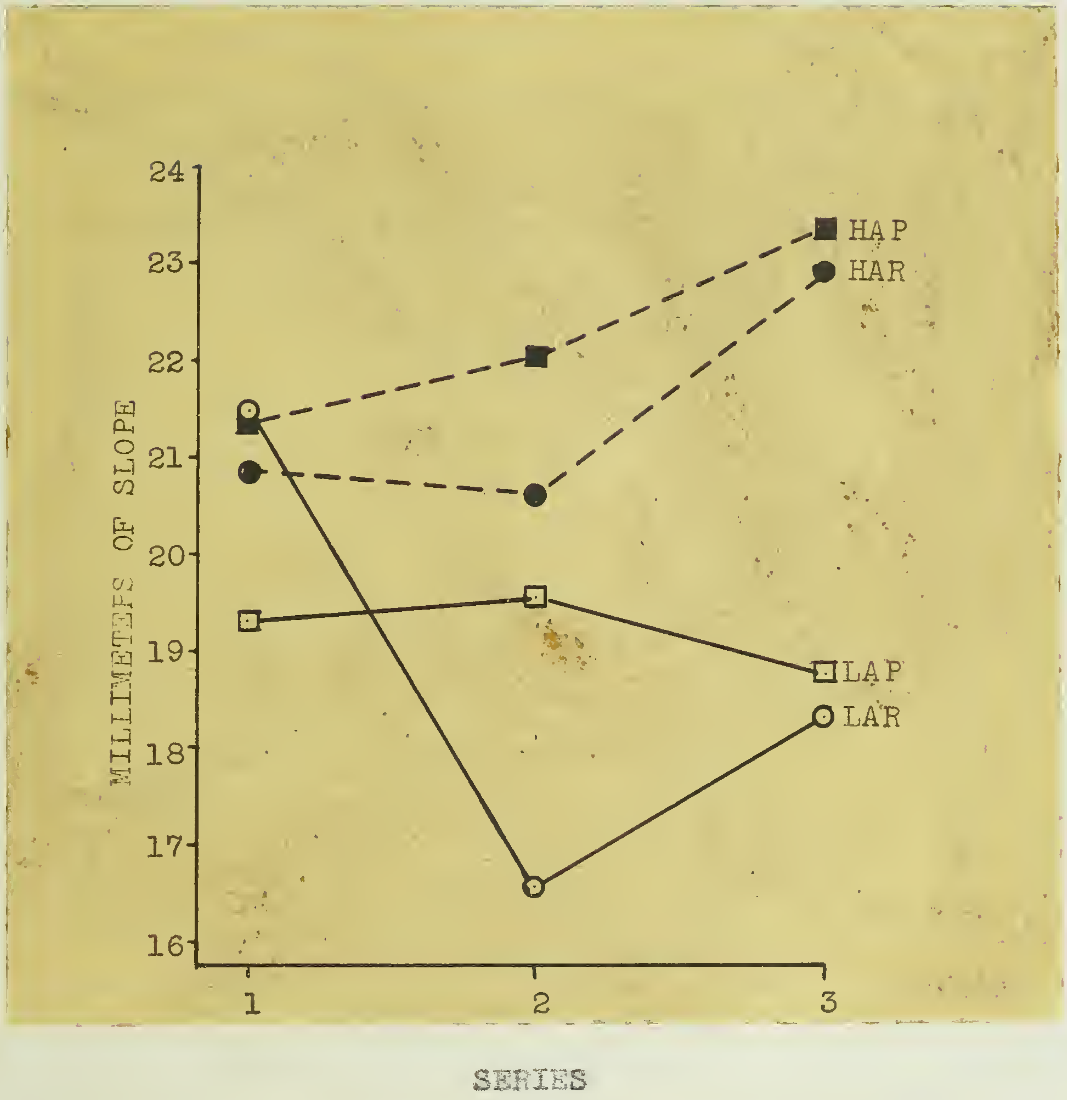

Figure 7. Mean discrimination scores for the four groups during each of the three series. For an explanation of the manner in which these scores were determined, see the text. Note: Better discrimination is indicated by the smaller numbers, i.e., toward the bottom of the graph.

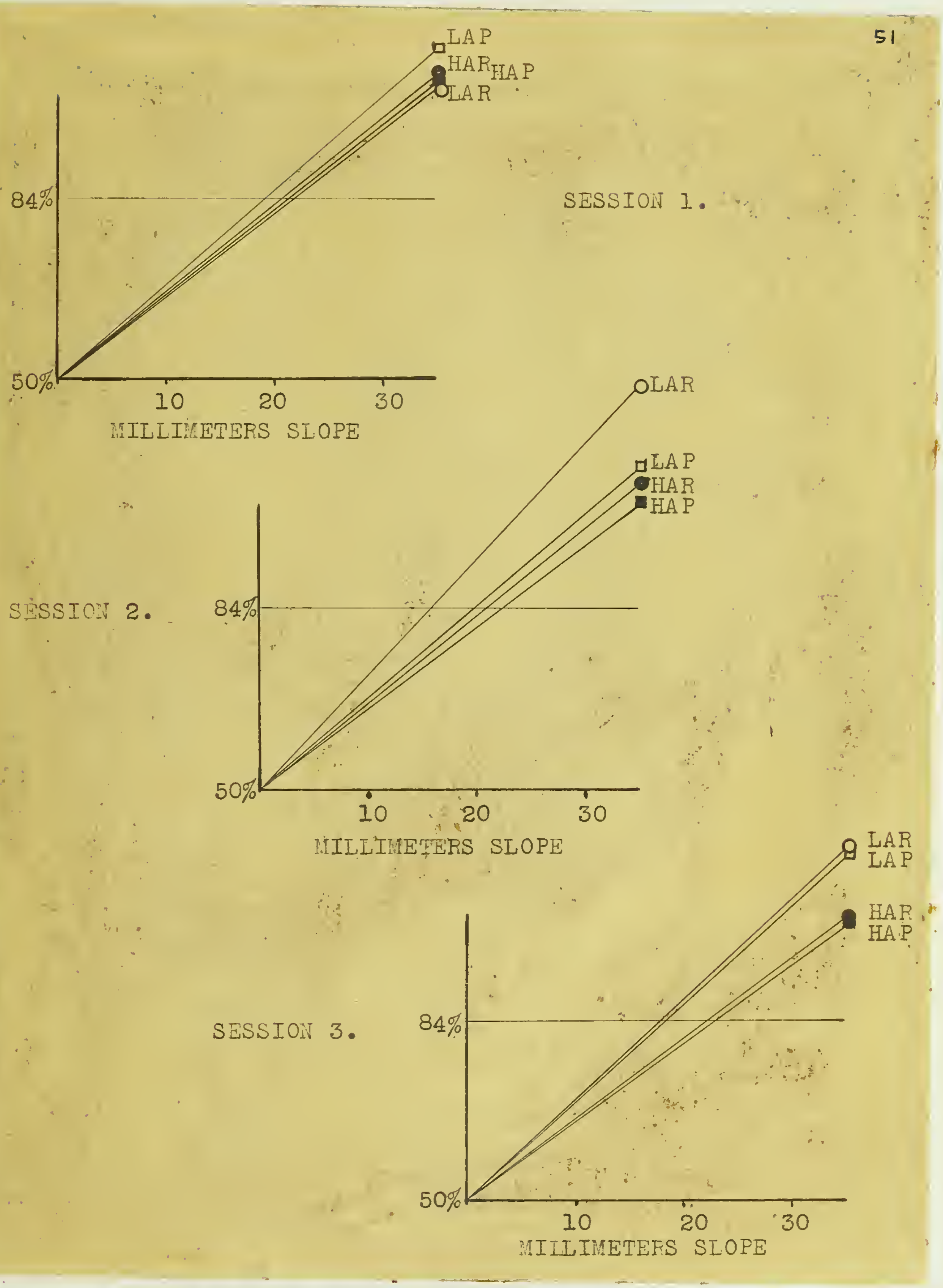

Figure 8. Slopes representing accuracy of discrimination, based on the mean slope for each group in each series. See text for method of determining slopes.

information that was useful to the subjects in improving their discrimination. It appears that the RIGHT signal actually interfered with discrimination somewhat for both the high and the low anxiety groups, while the WRONG signal shows no discernible effect on discrimination. This fact must not be construed as being contradictory to Garmezy's findings (12) that for a group of schizophrenic subjects discrimination becomes significantly poorer in comparison with the discrimination of a group of normal subjects when a punishing WRONG signal is introduced into the discrimination situation. There are marked differences in important features of the two discrimination tasks. A primary one is, perhaps, the fact that Garmezy used reward and punishment simultaneously, applying them to stimuli at the extremes of the range he employed, while in the present study only one incentive condition was used at a time and it was applied to stimuli which were very near the middle of the range of stimuli employed.

These findings support the major hypotheses of this research. Subjects evidencing more anxiety have shown a stronger tendency to avoid repeating a punished response than have subjects with less anxiety, and the higher anxiety subjects have shown a greater change in performance in avoiding repetition of a punishing signal than in inducing repetition of a rewarding signal. Differences were also observed between the high and low anxiety groups with respect to accuracy of discrimination as determined by two different measures. It appears that these differences may reflect differences in adaptation to the experimental situation.

CHAPTER IV

DISCUSSION

The data presented in the preceding section suggests that there are significant differences in the manner in which individuals who differ with respect to degree of anxiety, respond to rewarding and punishing experiences. The performance of individuals who experienced little anxiety was affected about equally by the rewarding and punishing conditions of this experiment. For the high anxiety subjects, on the other hand, the differences in response to the two incentive conditions are rather striking.

The tendency to increase the frequency of one response in order to reduce the frequency of another response that has become associated with social punishment is evidently considerably stronger for the high anxiety subjects than is the tendency to increase the frequency of occurrence of a response associated with a social reward.

It must be borne in mind that the range of differences in anxiety level employed in this research is relatively restricted

despite rather wide differences in mean anxiety scale scores for the two pairs of groups, i.e., 4.85 for the low and 28.62 for the high. All subjects, of both high and low anxiety groups, had demonstrated, by their membership in the General Psychology course from which they were selected, that they were capable of the degree of adjustment required for the completion of one or even two or more years of the academic and social demands of a major university. In view of the rather potent selection factors that determine the nature of a population such as the one used in this study, the extent of the obtained differences in performance are perhaps the more striking.

What, then, are some of the implications of these data?

Cast in a Hullian theoretical framework after the manner in which Spence and his students and associates have dealt with problems related to this one, the anxiety variable would be represented as a secondary drive. As such it would be thought of as summating with the other drive conditions existing in a subject at the time of response, to produce a higher generalized drive level for the subjects whose high scores on the anxiety scale indicate that they frequently experience a rather wide range of manifestations of anxiety. Conceived thus, anxiety has the status of an irrelevant drive which contributes to the total drive value or drive strength in a manner that is implied by the equation: $\bar{D} = 100 \frac{\dot{D} + D}{\dot{D} + M_d}$, where $\bar{D}$ represents the total or

the effective drive value, $\dot{D}$ represents the combined value of all irrelevant drives, D represents the value of the relevant drive[1] and M_d represents the physiologically maximum drive value, which is defined by Hull (18) as 100 motes.

Taylor (38), Rosenbaum (33), Amsel (1, 2) and others have interpreted differences in rate of conditioning, strength of response, etc., that have been observed for groups of humans and animals that differ in anxiety level, as resulting from variations in the value of anxiety conceived as an irrelevant drive. This implies the tacit assumption that the stimulus value of the drive stimulus (D) employed in an experimental task is equal for all subjects and that it is below the maximum drive value, i.e., $D \quad M_d$. This leads to the conclusion that the observed variations in response strength (and therefore in effective drive strength) must be contributed by variations in the irrelevant drive, anxiety. Such an assumption is not necessary, and may even be partially incorrect. Variations in response strength might equally well result from differences in the stimulus value of the drive stimulus (D) for different individuals rather than, or in addition to, variations in the value of irrelevant drive ($\dot{D}$). It is evident that an increase in either drive value or both should produce an increase in response

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[1] A relevant need or motivation is defined as one which is rewarded (or reduced) by the response under consideration; an irrelevant need or motivation is one that is present in the organism at the time the response occurs, but is not itself reduced by that response (2).

strength.

Conceptualizing anxiety as an irrelevant drive implies the notion that subjects with a high anxiety score bring into the experimental situation a pre-existing quantity of anxiety or a heightened level of anxiety, which results in a heightened generalized drive. May, in his rather extensive recent analysis of anxiety (25) takes the position that the concept of anxiety as a heightened level of tension or drive is incorrect. This is implied in his statement, "Sometimes persons who respond to relatively minor threats as though they were catastrophic situations are described as persons who 'carry' an 'inordinate quantity' of anxiety within themselves. This however is a misleading description. Actually these are persons who are inordinately vulnerable to threats..." (25, pp. 198-99). Greater vulnerability, in contrast to the level-of-anxiety notion, implies a personality characteristic which either leads the individual into more anxiety arousing situations, makes him sensitive to a wider variety of potentially threatening stimulus conditions, or makes him overreactive to stimuli which arouse little or no anxiety in others. In terms of this greater vulnerability concept the increases in response strength reported for subjects with higher anxiety would be interpreted as resulting from the greater value of the drive stimulus (D) for the more anxious individuals. The irrelevant drive construct is unnecessary by this formulation.

Both of these formulations assume that the differences in

response strength which were observed result from differences in effective drive strength for the two groups of subjects. The one implies that the high anxiety subjects brought a quantity of anxiety drive into the experimental situation which summated with the drive conditions aroused by the air puff, shock, WRONG signal, etc. (the drive arousing value of which was presumably the same for both high and low anxiety subjects) to produce the stronger response. The other implies that the drive levels of the two groups of subjects were not importantly different as they came to the experimental setting, but that the stimulus conditions aroused a greater avoidance drive in the group with the higher anxiety measure.

We would prefer to take a position which includes both of these formulations by recognizing that both prolonged conditions of heightened tension and/or anxiety and conditions of increased vulnerability to threat can exist either independently or simultaneously. In terms of the particular anxiety scale by which the members of the present experimental groups were chosen, this means we are assuming that individuals who attribute many manifestations of anxiety to themselves have either a higher level of anxiety or are more vulnerable to threat or both than individuals who attribute few manifestations of anxiety to themselves. It seems equally possible that either chronic elevated anxiety or hypersensitivity and overreactivity to threat could result in the types of anxiety manifestations described by the statements of the anxiety scale.

The distinction between level or vulnerability, then, is not crucial to an interpretation of the present findings. It throws the question back to one that is much more basic, and one which is beyond the scope of this paper; that is, what are the conditions which cause one individual to experience anxiety and its many manifestations more frequently and/or more intensively than another individual?

A further examination of the experimental setting and the behavior of our four groups of subjects in it may permit us to come to a clearer analysis of the obtained results.

As was suggested earlier the experimental design provides two major motivational conditions. One is provided by the instructions of the experiment and directs the subject to making the required discriminations. The other is provided by the RIGHT and WRONG signal and may be thought of as operating primarily at the level of the response. The relative importance of these two motivating conditions for a given group of individuals is at least in part reflected by the extent to which the performance of the experimental task (discriminating) is interfered with in the series in which the incentive signals were introduced.

As we have seen in Figure 7 there is a slight decrement in discrimination from series two to series three for all groups except LAP. Since, however, the magnitude of this decrement is small it is evident that the changes in response frequence which occurred in series three, presumably as a result of the incentive values of RIGHT and WRONG signals, did not conflict seriously

with the performance of the discrimination task. The effects of the incentive signals were evidently to increase the number of larger responses to all six of the test circles approximately equally, rather to effect them differentially as was the case in Garmezy's study.

These data are consistent with those of Hilgard, Jones, and Kaplan (17) who report poorer discrimination conditioning of a defensive eyelid response in high anxiety subjects. These investigators interpret their findings as suggesting not only a decrement in discrimination for the higher anxiety group but also, perhaps, a greater caution on their part. The apprehensive subjects may, they suggest, expect the experimenter to "fool" them at any time by reinforcing the negative or unreinforced signal. Thus the negative signal may remain potentially threatening to the higher anxiety group. This interpretation is consistent with our finding. Our high anxiety groups discriminated somewhat more poorly by the third discrimination series than did the low anxiety groups. This difference in accuracy of discrimination appears, however, to be related primarily to the anxiety variable rather than to the reward and punishment variables. The major effects of the reward and punishment conditions seem to be to induce increases or decreases in response frequencies rather than to modify accuracy of discrimination differentially.

It was seen earlier that the high anxiety subjects modified their response frequencies more slowly and to a lesser degree

under the reward condition than did the low anxiety subjects. This suggests reduced flexibility (or increased rigidity) in the higher anxiety group. Farber (7), in reviewing the animal studies of response fixation in which anxiety is defined as anticipation of shock, concludes that these studies have uniformly demonstrated a reduction in response variability for animals who have experienced shock in a given situation. The degree of resistance to change has been measured by the methods of extinction (nonreward) and of retraining (rewarding an alternative response).

At the human level Fisher (9) suggests that the amount of rigidity present in a subject should be viewed in terms of a ratio of rigidity shown when dealing with non-threatening tasks as opposed to rigidity shown when dealing with threatening (ego-involved) tasks. Cattell and Winder conclude on the basis of extensive factorial studies that "fear and anxiety, perhaps in special conditions only, act specifically to restrict the range of random behavior (the latter emanating either from reproduced past possible reactions or from new 'dispersion' behavior)" (5).

In summing up the clinical observations of the psychoanalytical school on this point, Fenichel (8) says that

> in the face of neurosis the ego acts to prevent further breakdown by adopting secondary adjustments that involve a curtailment of flexibility and freedom. Adjustments of this kind are encountered in behavior patterns through which dangerous situations are avoided or reassuring ones induced. In extreme cases the rigidity is a total one; in less extreme cases a relative elasticity may be preserved so that the rigid pattern becomes

pronounced whenever anxiety is felt, and is somewhat relaxed when an experience of reassurance permits the individual to ease the barriers.

Our data would suggest that a comparable reduction in flexibility is associated with anxiety within the normal range of anxiety experience.

If, then, the anxious individual is one who discriminates somewhat more poorly than the less anxious person and if his response to any threatening or punishing stimulus is a more exaggerated avoidance response, and if his flexibility in response selection and/or response modification is reduced to a certain extent, it is not difficult to see why modes of maladaptive behavior are apt to develop in the repeatedly or chronically anxious person. This could occur because 1) he is not so apt to perceive or discriminate the relevant cues in a complex or vague threatening situation, 2) in reacting more strongly to threat, with attempted withdrawal or avoidance he may succeed in reducing the discomfort of the immediate threat without removing himself from the real source of threat, or without removing the source of threat itself. If the source of threat is not adequately removed it will repeatedly threaten him and in so doing will create a situation (heightened anxiety) in which behavior is restricted and flexibility is reduced. Therefore the chances of his selecting an adequate response are reduced.

If reduced discrimination, reduced flexibility and exaggerated avoidance response tendencies are characteristic of

heightened anxiety, as the evidence strongly suggests, it appears unnecessary to make a distinction between normal and neurotic anxiety, as May (25), Mowrer (28) and others have done. May has proposed a distinction which recognizes neurotic anxiety as "that which occurs when the incapacity for coping adequately with threats is not objective but subjective, i.e., is due not to objective weakness but to inner psychological patterns and conflicts which prevent the individual from using his power." Further he states that "...normal anxiety [is] that which is used for a constructive solution to the problem which causes the anxiety, and neurotic [anxiety is] that which results in defense from and avoidance of the problem."

It is evident that these defining statements refer to different ways in which anxiety is dealt with rather than any differences in the anxiety itself. In other words, May describes here normal and neurotic means of coping with anxiety.

Mowrer (28) acknowledges indebtedness to May for having brought the problem of normal anxiety to his attention "with the emphasis it deserves," but he prefers to make a distinction between normal and neurotic anxiety on the basis of the element of dissociation (or repression) which he feels is always involved in neurotic anxiety. He points out that "it is this peculiarity which, by causing anxiety to occur out of its natural context, gives it its appearance of disproportionality." Mowrer's distinction, then, is based on the stimulus conditions in which the anxiety occurs. In essence Mowrer is saying that anxiety which

is aroused by an inadequate stimulus may be considered neurotic anxiety, and the mechanisms by which anxiety may be aroused under inadequate stimulation are dissociation and repression.

Here, again, there is no implication of either quantitative or qualitative differences between neurotic and normal anxiety. It would seem clearer, therefore, to consider only one kind of anxiety, i.e., qualitatively the same in the experience of both normal and neurotic individuals, but to recognize that there are individual differences in the frequency and the intensity of anxiety experienced, differences in the sources of anxiety arousal and differences in methods of coping with anxiety. In addition, although there may be utility in some recognition of differences in the effectiveness with which anxiety arousing experiences are coped, there is little doubt that ratings of a quality like "effectiveness" would be found to fall along a contimuun, rather than show any sharp increase at a point which could be taken to indicate the beginning of neurotic methods of dealing with anxiety.

As for the effectiveness with which our experimental groups coped with the punishment condition provided for them, two aspects of the situation must be considered. In terms of the effectiveness with which punishment was avoided, the high anxiety group was more effective than the low. In terms of the effectiveness with which the discrimination task was performed, however, the low anxiety group has a slight superiority. This superiority appears to be due not to superior responsivity to

the punishment of the experimental situation but to the advantage they held during the earlier discrimination series (series 2). Actually both groups performed effectively in this experimental situation, for the response modification that was observed took place within the area of ambiguity of the stimulus continuum and did not interfere significantly with the performance of the experimental task.

If we think of the experimental task as analogous to other life situations, it follows that the greater ambiguity of more complex life situations provides a broader area within which avoidance responses may be expected to take place. In the experimental setting the discrimination task was made explicit by a set of rather specific instructions. Ordinarily, one is not provided with a neat set of instructions by which to guide his behavior. In the experimental task ambiguity resulted from the relative dissimilarity of the standard stimuli and the test stimuli, i.e., the standard circles were, respectively, as much larger and smaller than the test circles as were the largest and smallest test circle different from each other. In life, the differences between "test" and "standard" stimulus configurations are often much greater. Another factor contributing to ambiguity in the experimental setting was the time interval between the presentation of the standard circles and the test circles. Frequently in life situations the time intervals are considerably more extended. In life, too, the meaning aspects of the stimulus configurations, the response sequences and the motivational

factors are usually much more complex than those of the experimental setting.

Thus the chances that a response which serves to avoid an immediate threat of punishment may lead to unforeseen consequences which are as punishing or even more punishing than the original threat are considerably greater in many life situations than in the experimental setting. If anxiety increases the urgency of avoiding punishment, as the data suggest, the chances that avoidance response tendencies will interfere with the longer range task of life adjustment are increased in the individual with elevated anxiety.

The implication throughout the preceding discussion has been that it is anxiety itself which is responsible for the observed differences in the performance of the experimental groups. To a certain extent this is probably true. If, however, anxiety is a response which occurs in the face of threatening stimulus conditions or in the anticipation of punishment, and if anxiety motivates avoidant or defensive responses, it is difficult to explain differences in performance under reward conditions as resulting directly from differences in degree of anxiety. Can one explain the tendency of the high anxiety group to repeat the rewarded response less frequently than the low anxiety group in terms of the greater anxiety of the former group? Certainly this is not as clear a relationship as the one which could exist between anxiety and the strength of avoidance responses to threatening or punishing stimuli.

There are, however, at least two possible explanations for the observed differences in the reward behavior of the two groups. Some subjects reported that when the RIGHT signal failed to light they tended to interpret it as meaning that the response was wrong. This tendency was quite strong in a group of schizophrenic subjects who were tested earlier, and the present experimental subjects were asked if they were aware of feeling that the absence of the RIGHT signal meant wrong. There were, however, no more high than low anxiety subjects who reported making an interpretation of this sort. Nevertheless, it is possible that it may have operated more or less unconsciously or that they refused to admit having made an interpretation of this sort after the experimental instructions had specifically warned against doing so. This interpretation of the results must, however, remain conjectural.

Another possible explanation of the results may be that there is a common personality characteristic, such as insecurity, which accounts for both the differences in anxiety and the differences in the performance of the two groups. This formulation implies a distinction between the anxiety response and the anxious individual. The anxious individual is one for whom the anxiety response is a frequent occurrence. A reason for the frequency of occurrence of the anxiety response may be feelings of insecurity which renders an individual vulnerable to threat. Greater insecurity may also contribute to habit patterns which can account for the differences in the performance of the two

experimental groups under the reward conditions. Insecure individuals might well be expected to be more cautious in modifying an established response pattern until they were fairly certain that such modification would consistently bring reward. Such an explanation would account for the differences in performance of our two experimental groups under reward without utilizing the concept of anxiety directly.

Anxiety is probably very much involved indirectly through its role in the development of insecurity. Repeated threat, i.e., the repeated experience of being confronted with situations with which one does not feel able to cope, is probably an important factor in the etiology of insecurity. The problems raised by this extension of the present experimental data suggests a direction for further exploratory research.

CHAPTER V

SUMMARY AND CONCLUSIONS

The problem

The general purpose of the present study was to explore the role of anxiety in determining individual differences in responsivity to rewarding and punishing conditions. More specifically it was designed to test the hypotheses:

1) Associated with heightened anxiety will be found an increase in the strength of a voluntary response serving the avoidance of social punishment.

2) Associated also with heightened anxiety will be a decrease in the relative effectiveness of reward in inducing response modification.

The experimental task also permitted an exploration of the effects of anxiety, reward and punishment on discrimination performance.

The subjects

Sixty-four undergraduate General Psychology students were selected from the 265 students enrolled in the course. Of these

sixty-four subjects, thirty-two were designated low anxiety because of the low scores they obtained on a scale of manifest anxiety. The other thirty-two subjects were among those who made the highest anxiety scale scores and they constituted a high anxiety group. Half of each of these groups of subjects received reward and the other half punishment conditions. There were four experimental groups designated, respectively, low anxiety, reward (LAR), low anxiety, punishment (LAP), high anxiety, reward (HAR) and high anxiety, punishment (HAP).

The anxiety scale

The scale used in the selection of the experimental groups is one developed by Taylor (39) using 200 items from the Minnesota Multiphasic Personality Inventory, of which 65 constitute the anxiety scale. These 65 items describe expressions of manifestations of (as opposed to ways of dealing with) anxiety. Individuals classifying fewer than 8 of these items in the deviant direction make up the low anxiety groups while the high anxiety scores ranged from 20 through 46.

The experimental task

The experimental task consisted of a modified differential threshold visual size discrimination task. Six test circles were to be designated as being more like either a larger or a smaller standard circle, by means of a simple push or pull on a response switch. The standard circles were perceptably larger

and smaller, respectively, than the range of six test circles. After a period of familiarization with the standard circles, subjects were shown each test circle twelve times in a series of individual presentations in a systematically randomized order.

The experiment consisted of three presentations of the stimulus series. The first two presentations were identical for all groups, and consisted of simple discrimination of the circles of the stimulus series without any information being provided as to the correctness or incorrectness of either individual judgments or of the total series. During the third presentation, for the two "reward" groups, a signal box reading RIGHT lighted whenever they responded correctly for two of the "larger" test circles, i.e., whenever they called either of these two circles larger. The subjects were instructed that the lighting of the RIGHT signal meant that they had made a difficult discrimination correctly.

For the subjects in the punished groups, a signal box lighted to read WRONG whenever they called one of these same two "larger" test circles small. The subjects were told that the lighting of the WRONG signal meant that they had responded incorrectly for a circle that they should by now be able to discriminate, on the basis of standards set by their classmates.

The results

Measures based on the number of judgments of "larger," showed insignificant differences between groups during series

one and two, indicating that they were essentially equated groups. Under the condition of punishment the high anxiety group exhibited a statistically significant increase in number of larger responses over the rewarded high anxiety group and over the punished low anxiety group. These data support the two major hypotheses of this study, namely, 1) the high anxiety subjects showed a greater increase in the frequency of a voluntary response which enabled them to avoid punishment than did the low anxiety subjects, and 2) the high anxiety subjects in contrast to the low anxiety subjects showed a greater increase in response frequencies under punishment, than under reward. In addition it was found that the high anxiety subjects showed a lesser increase in the response frequency under reward than did low anxiety subjects.

Differences were noted also between all the high anxiety subjects taken together and all the low taken together on two other measures. The low anxiety subjects showed a somewhat greater tendency to improve their judgments of the size relationships between the circles from series one to series two than did the high anxiety subjects. At the same time, for a measure of discrimination, the high anxiety groups became progressively poorer and the low anxiety groups became progressively better, until for series three the differences between the two groups were statistically significant. Since both of these measures of difference seem to be related primarily to the anxiety variable, and to have little, if any, relation to the rewarding and

punishing conditions, they are considered to reflect differences in adaptation to the experimental situation for the two subject groups.

These results were discussed in terms of their relation to the findings of several other studies, and in terms of their meaning for alternative conceptualizations of anxiety.

Conclusions

In a setting in which RIGHT and WRONG signals serve as incentives for the modification of the relative frequencies of a pair of antagonistic voluntary responses, it has been shown that:

1) Subjects with heightened anxiety tend to avoid repeating a punished response more quickly and more strongly than do subjects with a minimum of anxiety.

2) Subjects with heightened anxiety tend to modify their responses more quickly and more extensively in avoiding social punishment than in attaining social reward.

3) A comparable difference in responsivity to reward and punishment was not found for subjects with minimum anxiety. The rate and the extent of response modification for these subjects was approximately equal for the two incentive conditions.

4) There is some evidence which suggests that the subjects with minimum anxiety have a slight advantage over the high anxiety subjects in terms of their ability to improve their discrimination performance during the course of the experimental session. This difference appears to be relatively independent of the reward and punishment conditions.

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APPENDICES

APPENDIX I

THE ANXIETY SCALE

THE NUMBERS OF THE ITEMS CONSTITUTING THE
ANXIETY SCALE ARE ENCIRCLED

1. I like dramatics.

2. I believe in law enforcement.

3. I have several times had a change of heart about my life work.

4. Sometimes when I am not feeling well I am cross.

5. I have sometimes felt that difficulties were piling up so high that I could not overcome them.

6. I am against giving money to beggars.

7. I enjoy social gatherings just to be with people.

8. I must admit that I have at times been worried beyond reason over something that really did not matter.

9. I am not easily angered.

10. I am very careful about my manner of dress.

11. I sweat very easily even on cool days.

12. I would like to wear expensive clothes.

13. There is very little love and companionship in my family as compared to other homes.

14. I am entirely self-confident.

15. I feel uneasy indoors.

16. People often disappoint me.

17. I sometimes tease animals.

18. I have very few fears compared to my friends.

19. I like or have liked fishing very much.

20. I enjoy a race or game better when I bet on it.

21. I am happy most of the time.

22. I strongly defend my own opinions as a rule.

23. At times I have very much wanted to leave home.

24. I frequently notice my hand shakes when I try to do something.

25. I like movie love scenes.

26. Whenever possible I avoid being in a crowd.

27. I am not unusually self-conscious.

28. I forget right away what people say to me.

29. There seems to be a lump in my throat much of the time.

30. I like to poke fun at people.

31. At times I feel like smashing things.

32. I am usually calm and not easily upset.

33. My father was a good man.

34. I believe I am being followed.

35. I have had periods in which I lost sleep over worry.

36. I believe my sense of smell is as good as other people's.

37. I almost never dream.

38. I feel weak all over much of the time.

39. My hearing is apparently as good as that of most people.

40. I am easily downed in an argument.

41. At times I think I am no good at all.

42. I have to urinate no more often than others.

43. Someone has been trying to rob me.

44. Life is a strain for me much of the time.

45. I was fond of excitement when I was young (or in childhood).

46. When I am cornered I tell that portion of the truth which is not likely to hurt me.

47. I cannot keep my mind on one thing.

48. I have been quite independent and free from family rule.

49. I dislike having people about me.

50. I have had no difficulty starting or holding my urine.

51. It does not bother me that I am not better looking.

52. Sometimes I am sure that other people can tell what I am thinking.

53. I am troubled by attacks of nausea and vomiting.

54. I gossip a little at times.

55. I readily become one hundred per cent sold on a good idea.

56. I am very seldom troubled by constipation.

57. I certainly feel useless at times.

58. My people treat me more like a grown-up.

59. I have been inspired to a program of life based on duty which I have since carefully followed.

60. I have been afraid of things or people that I knew could not hurt me.

61. I have had no difficulty in keeping my balance in walking.

62. I am sure I get a raw deal from life.

63. I hardly ever notice my heart pounding and I am seldom short of breath.

64. I do not read every editorial in the newspaper every day.

65. I am never happier than when alone.

66. I am certainly lacking in self-confidence.

67. I have diarrhea once a month or more.

68. It is great to be living in these times when so much is going on.

69. At times I have fits of laughing and crying that I cannot control.

70. My hands and feet are usually warm enough.

71. I have had very peculiar and strange experiences.

72. Sometimes I feel as if I must injure either myself or someone else.

73. I shrink from facing a crisis or basis.

74. I can stand as much pain as others can.

75. Someone has it in for me.

76. I practically never blush.

77. I do not have spells of hay fever or asthma.

78. I am afraid of being alone in a wide-open place.

79. I worry quite a bit over possible misfortunes.

80. It makes me nervous to have to wait.

81. At times I have worn myself out by undertaking too much.

82. It makes me angry to have people hurry me.

83. I blush no more often than others.

84. Some of my family have habits that bother and annoy me very much.

85. My parents have often objected to the kind of people I went around with.

86. Several times a week I feel as if something dreadful is about to happen.

87. Almost every day something happens to frighten me.

88. I have never done anything dangerous for the thrill of it.

89. Some people are so bossy that I feel like doing the opposite of what they request, even though I know they are right.

90. My judgment is better than it ever was.

91. I am afraid of finding myself in a closet or small closed place.

92. I do not like to see women smoke.

93. If I were an artist I would like to draw children.

94. If I were in trouble with several friends who were equally to blame, I would rather take the whole blame than to give them away.

95. I feel anxiety about something or someone almost all the time.

96. Once in a while I put off until tomorrow what I ought to do today.

97. During one period when I was a youngster I engaged in petty thievery.

98. I have no trouble swallowing.

99. The future is too uncertain for a person to make serious plans.

100. When I get bored I like to stir up some excitement.

101. I find it hard to keep my mind on a task or job.

102. I believe in a life hereafter.

103. I have never been in love with anyone.

104. Often I feel as if there were a tight band around my head.

105. I get all the sympathy I should.

106. My family does not like the work I have chosen (or the work I intend to choose for my life work.)

107. I am more sensitive than most other people.

108. I enjoy many different kinds of play and recreation.

109. At periods my mind seems to work more slowly than usual.

110. I have often been frightened in the middle of the night.

111. I go to church almost every week.

112. I have often found people jealous of my good ideas, just because they had not thought of them first.

113. I have very few headaches.

114. Usually I would prefer to work with women.

115. I have reason for feeling jealous of one or more members of my family.

116. I have nightmares every few nights.

117. I enjoy the excitement of a crowd.

118. I like to keep people guessing what I'm going to do next.

119. I hate to have to rush when I am working.

120. My sleep is fitful and disturbed.

121. I do not mind being made fun of.

122. I get mad easily and then get over it soon.

123. I dream frequently about things that are best kept to myself.

124. It is always a good thing to be frank.

125. I sometimes feel that I am about to go to pieces.

126. Some of my family have quick tempers.

127. My relatives are nearly all in sympathy with me.

128. I worry over money and business.

129. I easily become impatient with people.

130. At times I have a strong urge to do something harmful or shocking.

131. I enjoy children.

132. My mouth feels dry almost all the time.

133. I like to know some important people because it makes me feel important.

134. Everything tastes the same.

135. I am a high-strung person.

136. My memory seems to be all right.

137. I would certainly enjoy beating a crook at his own game.

138. I work under a great deal of tension.

139. I do not worry about catching diseases.

140. I believe women ought to have as much sexual freedom as men.

141. Sometimes, when embarrassed, I break out in a sweat which annoys me greatly.

142. My daily life is full of things that keep me interested.

143. I can remember "playing sick" to get out of something.

144. I am afraid to be alone in the dark.

145. I am liked by most people who know me.

146. Most people are honest chiefly through fear of being caught.

147. Sometimes I become so excited that I find it hard to get to sleep.

148. I have never had a fit or convulsion.

149. I think most people would like to get ahead.

150. I believe I am no more nervous than most others.

151. I have periods of such great restlessness that I cannot sit long in a chair.

152. Sometimes I enjoy hurting persons I love.

153. Policemen are usually honest.

154. I have strong political opinions.

155. I frequently find myself worrying about something.

156. I seldom worry about my health.

157. I am attracted by members of the opposite sex.

158. I wish I could be as happy as others seem to be.

159. I often must sleep over a matter before I decide what to do.

160. I like to let people know where I stand on things.

161. It is all right to get around the law if you don't actually break it.

162. I am often afraid that I am going to blush.

163. I usually expect to succeed in things I do.

164. I would like to be a florist.

165. I do not like everyone I know.

166. Much of the time my head seems to hurt all over.

167. Several times I have been the last to give up trying to do a thing.

168. I have been told that I walk during sleep.

169. I am easily embarrassed.

170. Once in a while I laugh at a dirty joke.

171. I am very religious (more than most people).

172. I seem to be about as capable and smart as most others around me.

173. I cry easily.

174. I feel sure that there is only one true religion.

175. I have never been in trouble with the law.

176. I am troubled by discomfort in the pit of my stomach every few days or oftener.

177. I am greatly bothered by forgetting where I put things.

178. In my home we have always had the ordinary necessities (such as enough food, clothing, etc.)

179. I am bothered by acid stomach several times a week.

180. I usually work things out for myself rather than get someone to show me how.

181. I am embarrassed by dirty stories.

182. I never worry about my looks.

183. I do not tire quickly.

184. It is safer to trust nobody.

185. The only miracles I know of are simply tricks that people play on one another.

186. I have a great deal of stomach trouble.

187. What others think of me does not bother me.

188. I get angry sometimes.

189. I am afraid when I look down from a high place.

190. I feel hungry almost all the time.

191. I am in just as good physical health as most of my friends.

192. I enjoy gambling for small stakes.

193. I like to flirt.

194. My mother was a good woman.

195. I am inclined to take things hard.

196. I have used alcohol excessively.

197. I am made nervous by certain animals.

198. I would like to be a singer.

199. There is something wrong with my mind.

200. I find it hard to make talk when I meet new people.

RESPONSE FORMS

1. yes no ?
2. yes no ?
3. yes no ?
4. yes no ?
5. yes no ?
6. yes no ?
7. yes no ?
8. yes no ?
9. yes no ?
10. yes no ?
11. yes no ?
12. yes no ?
13. yes no ?
14. yes no ?
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97. yes no ?
98. yes no ?
99. yes no ?
100. yes no ?

RESPONSE FORMS -- 2

101. yes no ?
102. yes no ?
103. yes no ?
104. yes no ?
105. yes no ?
106. yes no ?
107. yes no ?
108. yes no ?
109. yes no ?
110. yes no ?
111. yes no ?
112. yes no ?
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191. yes no ?
192. yes no ?
193. yes no ?
194. yes no ?
195. yes no ?
196. yes no ?
197. yes no ?
198. yes no ?
199. yes no ?
200. yes no ?

PROCEDURE GUIDE PROVIDED THE INSTRUCTORS WHO SUPERVISED ADMINISTRATION OF THE ANXIETY SCALE

Distribute RESPONSE FORMS first.

Have students write their NAMES, the DATE, and their 91 SECTION on the BACK of the response forms, at the TOP of the page.

When this has been done explain that in a few minutes you are going to distribute a series of statements which are representative of those used in a number of personality schedules or inventories that have found fairly broad current usage. In fact, this collection of statements is one inventory which has been found to be a useful research tool when used on a group basis.

It is being presented at this time 1) because it will come up for discussion along with other personality research tools during the next semester under the section on personality, and this prior acquaintance is felt desirable, 2) also one of our doctoral candidates is in the process of pushing a little further some of the research in which this schedule has proven a useful tool.

You may want to emphasize that it is in the interest of the student with his full time schedule that we are taking this opportunity to combine instruction and research in this way.

It might be well to emphasize also that the value of a project of this sort whether it be for the instructional purpose of becoming acquainted with this type of research tool, or whether it be for use in a research project, or for personal use in a guidance or counselling situation, depends on the matter-of-factness with which the statements are classified.

If the question is raised, or if you wish, you may explain that the teaching staff is not interested in the classifications or responses made by the students, and that the doctoral candidate is interested only in the group trends for a normal college population and not in individual responses.

DIRECTIONS

"I'm going to distribute the inventory statements now. Please do not write on them. Read each statement and decide whether it is true in respect to yourself. If it is true, or mostly true, circle the "yes" after the number corresponding to the statement you have just read. If the statement is not usually true or not true at all, circle the "no". Only if you cannot make an honest classification of a statement under one of the other two columns should the "?" be used. Please be sure to record a response for every item. There are no right or wrong answers, just whether a statement applies to you or not."

IF YOU HAVE ANY QUESTIONS PLEASE ASK THEM NOW.

You may begin as soon as you get a booklet and you will be excused when you have finished and brought your inventory booklet and response forms up to me.

THE DISCRIMINATING POWER OF THE ANXIETY SCALE ITEMS

		The number of subjects who responded to the item in the deviant direction	
	Item	High Anx. N = 35	Low Anx. N = 38
5.	I have sometimes felt that difficulties were piling up so high that I could not overcome them.	30	16
8.	I must admit that I have at times been worried beyond reason over something that really did not matter.	32	24
11.	I sweat very easily even on cool days.	15	10
14.	I am entirely self-confident.	25	23
18.	I have very few fears compared to my friends.	13	6
21.	I am happy most of the time.	9	0
24.	I frequently notice my hand shakes when I try to do something.	21	0
27.	I am not unusually self-conscious.	19	6
29.	There seems to be a lump in my throat much of the time.	4	0
32.	I am usually calm and not easily upset.	18	3
35.	I have had periods in which I lost sleep over worry.	30	9
38.	I feel weak all over much of the time.	3	0
41.	At times I think I am no good at all.	29	3
42.	I have to urinate no more often than others.	16	7
44.	Life is a strain for me much of the time.	15	0

Item	High Anx. N = 35	Low Anx. N = 33
47. I cannot keep my mind on one thing.	18	1
50. I have had no difficulty starting or holding my urine.	15	6
53. I am troubled by attacks of nausea and vomiting.	2	0
56. I am very seldom troubled by constipation.	9	1
57. I certainly feel useless at times.	27	7
60. I have been afraid of things or people that I knew could not hurt me.	12	4
63. I hardly ever notice my heart pounding and I am seldom short of breath.	22	3
66. I am certainly lacking in self-confidence.	15	2
67. I have diarrhea once a month or more.	2	1
70. My hands and feet are usually warm enough.	15	5
73. I shrink from facing a crisis.	17	2
76. I practically never blush.	28	9
79. I worry quite a bit over possible misfortunes.	19	2
80. It makes me nervous to have to wait.	33	15
83. I blush no more often than others.	14	7
86. Several times a week I feel as if something dreadful is about to happen.	7	0
87. Almost every day something happens to frighten me.	4	0
91. I am afraid of finding myself in a closet or small closed place.	4	2
95. I feel anxiety about something or someone almost all the time.	25	1
98. I have no trouble swallowing.	11	1

	Item	High Anx.	Low Anx.
101.	I find it hard to keep my mind on a task or job.	21	2
104.	Often I feel as if there were a tight band around my head.	2	0
107.	I am more sensitive than most other people.	20	2
110.	I have often been frightened in the middle of the night.	13	1
113.	I have very few headaches.	12	0
116.	I have nightmares every few nights.	8	1
120.	My sleep is fitful and disturbed.	9	0
123.	I dream frequently about things that are best kept to myself.	15	0
125.	I sometimes feel that I am about to go to pieces.	20	0
128.	I worry over money and business.	14	3
132.	My mouth feels dry almost all the time.	3	0
135.	I am a high-strung person.	13	1
138.	I work under a great deal of tension.	19	0
141.	Sometimes, when embarrassed, I break out in a sweat which annoys me greatly	19	0
144.	I am afraid to be alone in the dark.	3	0
147.	Sometimes I become so excited that I find it hard to get to sleep.	31	15
150.	I believe I am no more nervous than most others.	19	7
151.	I have periods of such great restlessness that I cannot sit long in a chair.	29	7
155.	I frequently find myself worrying about something.	34	3

	Item	High Anx.	Low Anx.
158.	I wish I could be as happy as others seem to be.	22	4
163.	I am often afraid that I am going to blush.	12	0
166.	Much of the time my head seems to hurt all over.	1	0
169.	I am easily embarrassed.	27	0
173.	I cry easily.	8	1
178.	I am troubled by discomfort in the pit of my stomach every few days or oftener.	4	0
179.	I am bothered by acid stomach several times a week.	4	1
183.	I do not tire quickly.	20	1
186.	I have a great deal of stomach trouble.	3	0
190.	I feel hungry almost all the time.	16	4
195.	I am inclined to take things hard.	30	3

APPENDIX II

INSTRUCTIONS GIVEN TO SUBJECTS

INSTRUCTIONS GIVEN SUBJECTS

The specific instructions given each subject were as follows:

"You see I have a projector here with a film strip in it. On the film strip are some circles which look like this." (Here the subject was shown the first, smallest circle at the usual 1 sec. rate of exposure.) "You will notice that this timer started when I opened the shutter and it will stop when this lever over here is moved in either direction." (E demonstrates by moving the response lever. "That lets me know how long it is from the time the circle is shown until the lever is moved. You will notice also that this lever operates these two lights: when it is pushed, the white light goes on and when it is pulled, the red one lights. That is simply to let me know which way the lever is moved, as I will be sitting here out of sight of the lever. Now, if you will be seated over here I will explain further what we will be doing. Adjust your chair to a position from which you will be able to hold this lever easily.

"Now when you see the circle I am about to show you I'd like you to push the lever away from you." "That's right." (Or if the subject failed to respond he was asked, "Would you do that now, please.") "When you see this next circle which is a little larger than the last one I'd like you to pull the lever toward you." "That's right. Did you notice the difference in size between these two circles?" If the answer was, "yes", the subject was asked, "Which one does this one look like?", and the larger one was shown again. If the S admitted he didn't notice any difference between them, he was shown each again, and warned in advance which was about to be shown. As soon as he indicated that he was aware of the difference he was practiced with three exposures of each circle presented in broken sequence. As soon as he had responded correctly during six consecutive presentations of this sort he was told, "Now in addition to these two circles that I have just shown you, I will be showing you some others that are in between these in size. For these other circles I'd like you to decide in each case whether it looks more like the larger of these two circles I have just shown you, in which case I'd like you to pull the lever, or whether it looks more like the smaller of these two circles I have just shown you in which case I'd like you to push the lever.

"I'll show you this largest and smallest circle again several more times in order to better acquaint you with them and so that you can practice pushing for the smaller one and

pulling for the larger one. Then we will go into a series of circles of sizes in between these two and you are to judge which are more like the smaller and which more like the larger of these two circles. Occasionally during the series this largest and smallest circle will reappear to refresh your memory but the majority of the circles will be in-between in size. If at any time you happen not to be looking at the screen when a circle is being presented, let me know so that I can present it again because I would like a judgment in each case not just a guess. Also, if at any time you happen to move the lever in the wrong direction for any reason, correct it by moving it the way you intended, even if you change your mind about a judgment after you have made it. Remember I'm interested in how accurately you can judge these circles. Do you have any questions?" "All right, which circle does this look like?" "That's right. And this one?" "Yes." No more comments unless the subject asked a specific question. If the question was other than procedural its answer was deferred until the end of the experimental session.

After the experimental series of circles had been presented the subject was told, "That was a practice series. How did it go?" or "How do you feel you did?" The subject's comments were recorded and then the subject was told, "I'd like to show you the largest and smallest circles again several times and then show you a series of in-between size circles again. Let's see how it goes this time."

At the close of this series the subject was again asked how he felt he had done and was engaged in conversation for about five minutes. The signal box to be used during the next series was then set up and the subject was asked to move his response lever in a sequence that demonstrated to him that the signal box would light up as a result of his response--in either direction depending on the setting of E's controlling switch. The subjects for whom the box lighting to say RIGHT was used, were then told, "This time this box is going to light up when you respond correctly for a few of the circles which are most difficult to discriminate. It won't light up for all of the circles. Much of the time you know when you are right anyway, but for a few of the circles which are most difficult to discriminate, when you respond correctly this box will light up to tell you that you made a difficult discrimination and responded correctly. When the box doesn't light up, then, that doesn't necessarily mean that that particular response was wrong because it won't light for all circles. But, when it does light you will know you made a difficult discrimination and got it right."

For the group, for whom the box lighting to say WRONG was used, the subject was told, "You have had a good deal of practice now so this time, when you respond in the wrong direction for a few of the circles which you should now be able to discriminate--based on how people have been able to do on this--this box will light up to tell you that was wrong--that you

discriminated poorly. It won't light for all circles so when it doesn't light that doesn't necessarily mean that that response was correct, but when it does light you will know that you have responded incorrectly for a circle which you should now be able to discriminate. I'll begin by showing you the largest and smallest circles again to reacquaint you with them and then I'd like to show you a series of in-between size circles again."

After this third series the subjects in both groups were asked, 1.) how they felt they had done--compared with the previous two series, 2.) which series they liked best, 3.) how many different sized circles there seemed to be, 4.) what changes in the situation, if any, were made by the introduction of the signal box, 5.) whether it was easier to either push or pull the lever, 6.) whether they had noted any tendency to call circles appearing high or low on the screen either large or small, 7.) whether they had noted any changes in the order, proportion of larger to smaller circles or any other differences in the three series of circles.

The session was closed by giving each student a brief exposition on psychophysical methods and measurements.

APPENDIX III

THE MANNER IN WHICH RESPONSES WERE RECORDED

THE MANNER IN WHICH RESPONSES WERE RECORDED

Responses were recorded in a manner which is indicated on the sample data sheet.

The data sheet

The numbers to the left of each of the four columns of the DATA SHEET represent the numbers by which each of the stimulus circles was designated. Numbers one and eight refer to the smaller and the larger standard circles respectively. Numbers two through seven designate the six test circles in order of increasing size. The order in which these numbers appear on the data sheet corresponds to the order in which the circles appear on the film strip, by means of which they were presented to the subjects. Since the numbers in all four columns represent a continuous series it will be seen that the data sheet provides space for recording the responses of a subject during two presentations of the series of stimuli. The appropriate spaces are indicated by the numbers 1 and 2 at the head of columns for both time and responses. It was necessary, therefore, to record the subject's responses for session three on a separate data sheet.

It will be noted that the L's in the response columns (headed R) are opposite numbers 5, 6, 7 and 8, the numbers of the larger circles. These L's were inserted to simplify the recording of responses by enabling E to record only errors.

The recording of responses

Whenever a subject's response indicated a judgment of smaller for a larger circle, E circled the L opposite.

Conversely, for a smaller circle judged larger, E placed a circle in the "box" opposite.

Since the appropriate response for each circle is indicated in the response column, L for the larger circles and a blank for the smaller circles, E was able to indicate which responses were incorrect simply by placing a circle either over the appropriate L or in the appropriate blank. This eliminated the necessity of recording every response and, what is perhaps more important, eliminated the necessity for translating the circle numbers into their corresponding size categories. The need for such a translation would increase somewhat the chances of errors in recording responses. An additional precaution was taken in order to prevent errors arising from the recording in column 1 of errors which occurred during session two. A red pencil was used to record responses for series two; black was used for series one and three.

Tabulating responses

Templates were prepared to facilitate scoring. Scoring was done in terms of the number of judgments of larger for each circle. With the templates this meant simply counting the number of circles appearing in the holes of the templates for the smaller circles, 1, 2, 3 and 4, and in counting the number of uncircled L's for the larger circles. These totals were recorded in the columns at the bottom of the data sheet.

Response time

The response time was recorded for each response, but these data are outside the scope of the present study.

DATA SHEET

Name ______________________________ __________ Expr. Control No. ________

Time 1	Time 2	R 1	R 2	Time 1	Time 2	R 1	R 2	Time 1	Time 2	R 1	R 2	Time 1	Time 2	R 1	R 2
1				2				4				7		L	L
8		L	L	6		L	L	5				6		L	L
1				6		L	L	1				3			
8		L	L	4				5		L	L	6		L	L
1				5		L	L	5		L	L	2			
8		L	L	1				3				5		L	L
4				3				7		L	L	3			
2				4				5		L	L	5		L	L
3				4				5		L	L	2			
5		L	L	7		L	L	4				4			
6		L	L	3				4				6		L	L
3				3		L	L	2				7		L	L
3				5		L	L	6		L	L	3			
7		L	L	2				1				2			
5		L	L	7		L	L	7		L	L	3			
4				7		L	L	7		L	L	5		L	L
6		I	L	4				2				6		L	L
8		L	L	8		L	L	3				6		L	L
2				6		L	L	2				7		L	L
5		L	L	2				7		L	L	4			
7		L	L	2				5		L	L	4			

Left Responses R - C		Left Responses R - P	
1		1	
2		2	
3		3	
4		4	
5		5	
6			
7		7	
8		8	

Large Responses Session 1. Large Responses Session 2.

APPENDIX IV

TABLES

TABLE XI

THE NUMBER OF "LARGER" JUDGMENTS PER CIRCLE FOR EACH SUBJECT IN GROUP LAR

Subj.	Ca	Gi	Br	Mc	Sm	Da	Le	El	Po	Fl	Ga	Do	Go	Ya	Dr	Co	Sum	Mean
Circle Number								Series 1										
2	1	0	0	1	0	0	0	0	2	1	4	3	0	2	5	7	26	1.62
3	1	1	1	2	2	2	3	5	3	2	7	6	10	7	7	9	68	4.25
4	3	2	3	5	1	4	3	5	4	9	7	8	7	11	8	12	92	5.75
5	6	8	6	8	9	9	10	9	9	11	9	11	11	9	11	10	146	9.12
6	5	7	11	7	9	7	9	8	12	12	10	10	10	11	11	12	151	9.44
7	10	11	11	9	12	12	11	12	11	11	11	12	12	12	12	12	181	11.31
Sum	26	29	32	32	33	34	36	39	41	46	48	50	50	52	54	62	664	41.50
								Series 2										
2	1	0	0	0	3	1	0	0	0	0	0	2	0	1	0	6	14	.88
3	1	0	2	0	3	3	4	0	0	0	1	2	2	3	1	8	30	1.88
4	4	4	4	2	6	5	9	2	0	2	4	4	5	7	3	6	67	4.19
5	6	8	8	5	11	10	11	10	2	6	6	4	11	12	8	11	129	8.06
6	7	8	8	7	8	10	10	9	2	4	6	7	11	12	10	12	131	8.19
7	9	10	12	6	11	12	12	11	5	8	9	12	12	12	12	12	165	10.31
Sum	28	30	34	20	42	41	46	32	9	20	26	31	41	47	34	55	536	33.50
								Series 3										
2	3	0	0	0	0	0	3	2	2	2	4	5	1	6	2	9	39	2.44
3	6	2	0	1	3	2	6	2	5	4	5	4	3	5	3	8	59	3.69
4	10	8	3	3	8	4	12	6	6	4	8	9	8	10	9	11	119	7.44
5	12	9	6	8	9	11	10	11	12	9	8	9	10	12	10	11	157	9.81
6	12	9	12	6	10	11	12	9	11	11	8	12	11	12	10	12	168	10.50
7	12	12	12	11	12	12	12	12	12	11	11	12	12	12	12	12	189	11.81
Sum	55	40	33	29	42	40	55	42	48	41	44	51	45	57	46	63	731	45.69

TABLE XII

THE NUMBER OF "LARGER" JUDGMENTS PER CIRCLE FOR EACH SUBJECT IN GROUP LAP

Subj.	Ke	Ti	Er	Be	Mc	Co	Cr	Ca	Ke	Ad	Ma	Cd	Wi	Le	Bo	Po	Sum	Mean
Circle Number									Series 1									
2	0	0	0	0	2	1	0	0	0	1	4	1	1	1	1	4	16	1.00
3	2	0	2	1	2	2	2	1	2	3	1	1	1	4	3	3	30	1.88
4	0	5	3	4	4	5	6	5	5	7	4	7	8	6	8	9	86	5.38
5	4	3	5	5	6	7	10	9	10	8	10	10	11	10	11	11	130	8.12
6	4	6	8	7	8	10	7	10	9	9	10	9	8	10	11	11	137	8.56
7	8	11	9	12	11	9	12	12	12	11	11	12	12	12	12	12	178	11.13
Sum	18	25	27	29	33	34	37	37	38	39	40	40	41	43	46	50	577	36.06
									Series 2									
2	0	0	1	0	0	0	0	0	0	2	1	0	1	1	1	2	9	.56
3	0	1	2	2	0	3	1	0	0	4	4	3	1	1	2	2	26	1.62
4	1	4	0	4	7	5	3	0	3	7	5	2	3	4	9	9	66	4.13
5	5	4	8	3	5	8	6	10	7	7	7	10	7	7	10	8	112	7.00
6	2	7	8	7	7	9	6	11	9	10	7	8	10	9	11	10	131	8.19
7	10	9	11	6	10	12	11	12	11	11	11	12	12	10	12	12	172	10.75
Sum	18	25	31	22	29	37	27	33	30	41	35	35	34	32	45	43	516	32.25
									Series 3									
2	0	1	0	3	1	2	0	2	1	0	4	0	0	3	2	9	28	1.75
3	3	7	1	8	1	7	7	2	3	3	9	4	2	3	5	7	72	4.50
4	3	8	2	8	5	10	9	6	2	7	6	7	5	11	7	10	106	6.63
5	9	8	8	11	7	9	9	10	7	9	10	9	11	11	9	8	145	9.06
6	11	9	3	9	8	11	10	11	8	9	11	11	11	10	11	12	155	9.69
7	12	12	9	12	12	12	12	12	8	12	12	12	12	12	12	12	185	11.56
Sum	38	45	23	51	34	51	47	43	29	40	52	43	41	50	46	58	691	43.19

TABLE XIII

THE NUMBER OF "LARGER" JUDGMENTS PER CIRCLE FOR EACH SUBJECT IN GROUP HAR

Subj.	Un	Ta	Ra	Wh	Hw	St	Sh	Ba	Li	Le	Ri	Bo	Re	Ed	Mc	Ir	Sum	Mean
Circle Number																		
									Series 1									
2	2	0	0	1	1	1	3	0	0	1	0	1	2	1	2	5	20	1.25
3	0	2	2	3	0	4	1	1	3	5	4	4	6	5	6	5	51	3.19
4	2	4	5	5	6	7	6	7	6	5	7	7	9	10	8	9	103	6.44
5	3	5	8	7	8	6	8	10	10	12	12	12	9	10	11	12	143	8.94
6	4	6	8	8	10	9	9	9	8	10	10	11	10	11	11	9	143	8.94
7	10	10	12	11	11	11	11	12	12	12	12	11	11	12	12	12	182	11.38
Sum	21	27	35	35	36	38	38	39	39	45	45	46	47	49	50	52	642	40.12
									Series 2									
2	0	0	0	0	0	1	0	0	0	0	1	1	1	3	3	3	13	.81
3	1	1	0	4	2	1	1	2	2	3	2	1	1	1	2	4	28	1.75
4	3	6	0	6	5	5	5	11	3	9	4	6	3	9	8	10	93	5.81
5	2	6	4	9	8	6	4	10	6	6	8	8	7	10	10	12	116	7.25
6	0	8	8	6	6	7	8	11	3	11	6	9	7	10	11	11	122	7.62
7	3	11	11	11	11	9	11	12	10	12	8	12	10	12	11	12	166	10.38
Sum	9	32	23	36	32	29	29	46	24	41	29	37	29	45	45	52	538	33.62
									Series 3									
2	0	2	0	3	0	1	2	3	0	5	1	4	0	2	6	4	33	2.06
3	1	2	5	4	1	3	1	3	2	8	5	5	2	8	4	7	61	3.81
4	2	5	4	9	7	4	5	10	3	11	7	7	4	10	9	10	107	6.69
5	3	10	8	10	8	10	6	10	6	10	10	9	7	12	11	10	140	8.75
6	2	10	9	11	9	9	4	9	7	11	10	10	7	12	11	12	143	8.94
7	5	11	11	12	12	12	11	12	11	12	12	11	10	12	12	12	178	11.12
Sum	13	40	37	49	37	39	29	47	29	57	45	46	30	56	53	55	662	41.38

TABLE XIV

THE NUMBER OF "LARGER" JUDGMENTS PER CIRCLE FOR EACH SUBJECT IN GROUP HAP

Subj.	Bo	Sa	Ab	Ed	Po	Go	Ho	Bu	Ne	Hi	Ta	Ho	St	Fr	Ro	Bl	Sum	Mean
Circle Number																		
								Series 1										
2	0	0	0	0	1	2	0	2	0	1	3	1	0	3	2	7	22	1.38
3	2	0	1	1	4	1	1	2	1	2	2	2	3	3	4	7	36	2.25
4	2	2	1	4	3	3	6	3	4	5	5	8	6	6	10	10	78	4.88
5	3	6	8	6	6	9	7	10	7	8	8	8	12	10	9	12	129	8.06
6	7	7	7	8	9	6	8	6	11	10	9	11	10	12	10	12	143	8.94
7	6	10	11	10	8	10	10	10	12	11	12	12	12	12	12	12	170	10.62
Sum	20	25	28	29	31	31	32	33	35	37	39	42	43	46	47	60	578	36.12
								Series 2										
2	1	0	0	2	0	0	0	2	2	3	0	3	0	2	1	4	20	1.25
3	2	0	0	2	0	3	1	4	4	4	1	5	3	2	4	4	39	2.44
4	3	2	0	5	3	5	4	5	8	6	5	7	8	9	9	9	88	5.50
5	5	2	3	8	2	6	10	7	10	8	10	10	8	12	8	10	120	7.50
6	8	5	2	7	4	9	4	9	12	9	10	11	9	11	10	12	132	8.25
7	11	7	7	11	5	11	9	10	12	11	12	12	11	12	12	11	164	10.25
Sum	30	16	12	35	14	34	28	37	48	41	38	49	39	48	44	50	563	35.19
								Series 3										
2	4	1	1	4	4	0	4	2	2	4	7	0	1	8	3	7	52	3.25
3	7	2	5	3	6	5	5	5	8	7	9	5	8	10	7	9	101	6.31
4	9	8	5	8	8	6	9	2	8	9	11	8	9	11	5	10	126	7.87
5	9	10	9	10	10	8	9	7	12	11	11	11	11	12	10	12	162	10.12
6	11	9	12	11	11	8	11	10	12	12	12	11	12	11	11	11	175	10.94
7	12	11	12	12	11	12	11	11	12	12	12	12	12	12	11	12	187	11.69
Sum	52	41	44	48	50	39	49	37	54	55	62	47	53	64	47	61	803	50.19

TABLE XV

THE SUBJECTS, THEIR SEX, THE DIRECTION IN WHICH THEY RESPONDED* AND THEIR VARIOUS ANXIETY SCALE SCORES

Group LAR

Subjects	Ca	Gi	Br	Mc	Sm	Da	Le	El	Po	Fl	Ga	Do	Go	Ya	Dr	Co
Sex	M	F	F	M	F	M	M	M	F	F	M	F	F	M	M	F
Resp. dir.	1	2	1	1	1	2	1	2	1	2	1	1	2	1	2	2
Anx. Score	7	6	7	4	7	2	5	5	5	7	5	4	3	4	2	6
Anxiety ?	0	0	2	0	2	0	0	1	1	1	1	4	2	0	2	1
Total ?	7	0	17	6	3	5	0	3	2	7	5	21	22	0	4	10
"L" score	0	2	0	0	0	0	0	0	3	0	2	2	0	1	2	1
"F" score	0	1	1	0	0	0	0	0	2	0	0	0	0	0	1	1

Group LAP

Subjects	Ke	Wi	Br	Be	Mc	Co	Cr	Sm	Me	Ad	Ha	Od	Mi	We	Bo	Re
Sex	F	M	F	M	M	M	M	F	M	M	M	F	F	M	M	M
Resp. dir.	2	1	2	1	1	2	2	1	2	2	1	2	1	1	2	1
Anx. Score	6	6	6	6	6	6	6	1	2	6	6	5	4	2	4	2
Anxiety ?	0	1	0	0	1	1	2	4	0	2	3	1	1	0	1	0
Total ?	13	13	0	1	2	1	9	16	2	12	14	6	2	0	5	0
"L" score	3	2	1	0	2	1	2	2	1	3	0	4	1	1	1	3
"F" score	0	1	2	3	0	1	0	0	2	3	1	0	2	1	2	1

* explanation at the end of table on following page

TABLE XV (Continued)

Group HAR

Subjects	Um	Ta	Ra	Wh	Hw	St	Sh	Ba	Li	Le	Ri	Bo	Re	Fd	Mc	Ir
Sex	M	M	M	M	M	M	M	M	M	F	M	F	M	F	M	F
Resp. Dir.	2	2	1	2	1	2	1	1	2	1	1	1	2	2	1	2
Anx. Score	36	24	29	30	30	32	35	29	37	21	29	24	21	24	36	27
Anxiety ?																
Total ?	21	4	8	5	3	6	6	29	34	6	4	5	7	19	6	16
"L" score	0	0	0	0	1	0	0	0	0	0	1	1	0	1	0	0
"F" score	4	1	4	3	2	2	2	3	1	0	2	2	3	1	1	1

Group HAP

Subjects	Bo	Sa	Ab	Ed	Po	Go	Ho	Bu	Ne	Hi	Ta	Ho	St	Fr	Ro	Bl
Sex	M	M	M	F	M	M	M	M	F	M	M	F	M	M	M	F
Resp. Dir.	1	2	2	1	2	1	1	2	1	2	2	1	2	1	1	2
Anx. Score	25	23	26	26	46	23	27	20	23	29	35	25	34	27	24	29
Anxiety ?																
Total ?	0	6	8	3	24	7	0	8	2	8	12	5	3	5	4	4
"L" score	0	0	0	0	1	0	1	0	0	0	0	0	1	3	1	1
"F" score	1	1	3	1	3	3	4	1	3	2	3	0	2	1	1	1

* The number 1 indicates that a subject pulled the response switch to indicate a judgment of larger, and pushed it to mean smaller; the number 2 means the subject pushed to mean larger, pulled to mean smaller.

TABLE XVI

A COMPARISON OF THE INCREASE IN NUMBER OF LARGER RESPONSES FROM SERIES ONE AND TWO COMBINED TO SERIES THREE WITH THE NUMBER OF REINFORCEMENTS OF THE RIGHT OR WRONG SIGNALS.

Group LAR

SUBJECTS	Increase in score	No. of reinforce.
1. Ca	28.0	24
2. Gi	10.0	18
3. Br	0.0	18
4. Mc	3.0	14
5. Sm	4.5	19
6. Da	2.5	22
7. Le	14.0	22
8. El	6.5	20
9. Po	23.0	23
10. Fl	8.0	20
11. Ga	7.0	16
12. Do	10.5	21
13. Go	-0.5*	21
14. Ya	7.5	24
15. Dr	2.0	20
16. Co	4.5	23

* The minus sign indicates a decrease in score from series one and two to series three.

TABLE XVI (continued)

Group LAP

SUBJECTS	Increase in score	No. of reinforce.
1. Ke	20.0	4
2. Wi	20.0	7
3. Br	-6.0	13
4. Be	25.5	4
5. Mc	3.0	9
6. Co	15.0	4
7. Cr	15.0	5
8. Sm	8.0	3
9. Me	-5.0	9
10. Ad	0.0	6
11. Ha	14.5	3
12. Od	5.5	4
13. Mi	3.5	2
14. We	12.5	3
15. Bo	0.5	4
16. Re	12.0	4

Group HAR

SUBJECTS	Increase in score	No. of reinforce.
1. Un	-2.0	5
2. Ta	10.5	20
3. Ra	8.0	17
4. Wh	13.5	21
5. Hw	3.0	17
6. St	5.5	19
7. Sh	-4.5	10
8. Ba	4.5	19
9. Li	-2.5	13
10. Le	14.0	21
11. Ri	8.0	20
12. Bo	4.5	19
13. Re	-8.0	14
14. Ed	9.0	24
15. Mc	5.5	22
16. Ir	3.0	22

TABLE XVI (continued)

Group HAP

SUBJECTS	Increase in score	No. of reinforce.
1. Bo	27.0	4
2. Sa	20.5	5
3. Ab	24.0	3
4. Ed	16.0	3
5. Po	27.5	3
6. Go	6.5	8
7. Ho	19.0	4
8. Bu	2.0	7
9. Ne	12.5	0
10. Hi	16.0	1
11. Ta	23.5	1
12. Ho	1.5	2
13. St	12.0	1
14. Fr	17.0	1
15. Ro	1.5	3
16. Bl	6.0	1

TABLE XVII

THE DISCRIMINATION SCORES OF EACH SUBJECT IN EACH GROUP. THE METHOD OF OBTAINING THESE SCORES IS DESCRIBED IN DETAIL IN THE TEXT.

Group LAR

SUBJECTS	Series		
	1	2	3
1. Ca	35.0	32.5	15.0*
2. Gi	18.0	12.0	12.5
3. Br	15.5	13.0	8.0
4. Mc	32.5	14.0	17.0
5. Sm	13.0	35.0	12.5
6. Da	13.0	16.5	11.0
7. Le	17.0	12.5	15.0
8. El	15.5	12.0	17.5
9. Po	18.5	16.0	16.5
10. Fl	17.0	15.0	30.5
11. Ga	48.0	21.0	49.0
12. DO	22.5	18.0	15.5
13. Go	14.0	11.0	18.5
14. Ya	19.0	11.0	14.5
15. Dr	26.0	12.5	20.5
16. Co	19.5	13.0	20.0
Mean	21.50	16.56	18.34
S. D.	9.30	7.01	9.28

*Smaller numbers indicate a greater steepness of slope and therefore better discrimination.

TABLE XVII (continued)

Group LAP

SUBJECTS	Series		
	1	2	3
1. Ke	18.0	15.5	13.0
2. Wi	14.0	21.0	19.0
3. Br	22.0	18.0	22.0
4. Be	12.5	24.5	23.0
5. Mc	32.0	13.0	17.0
6. Co	31.0	13.0	20.0
7. Cr	12.0	19.0	15.0
8. Sm	12.0	8.0	15.0
9. We	12.5	13.0	39.5
10. Ad	29.5	31.5	13.5
11. Ha	26.0	40.0	25.0
12. Od	16.5	14.0	13.0
13. Mi	17.0	17.0	12.0
14. We	19.5	26.5	17.5
15. Bo	16.5	17.5	20.0
16. Re	17.5	21.5	16.0
Mean	19.31	19.56	18.78
S. D.	6.66	7.58	6.52

TABLE XVII (continued)

Group HAR

SUBJECTS	Series 1	 2	 3
1. Un	19.0	—	33.5
2. Ta	23.0	18.5	26.5
3. Ra	13.5	10.0	19.0
4. Wh	29.5	21.0	23.0
5. Hw	18.0	18.0	12.5
6. St	31.0	34.0	19.0
7. Sh	29.5	17.0	33.5
8. Ba	11.5	13.0	20.0
9. Li	13.0	22.5	19.0
10. Le	17.0	13.0	27.5
11. Ri	12.5	37.0	18.0
12. Bo	20.0	16.0	40.0
13. Pe	38.5	29.0	21.5
14. Ed	18.0	16.0	15.0
15. Mc	19.5	27.0	23.5
16. Ir	20.5	17.0	15.5
Mean	20.88	20.60	22.94
S. D.	7.31	7.69	7.36

TABLE XVII (continued)

Group HAP

SUBJECTS	Series 1	 2	 3
1. Bo	23.0	30.0	23.5
2. Sa	14.5	16.5	27.5
3. Ab	16.0	15.0	13.0
4. Ed	20.0	34.5	19.0
5. Po	38.0	17.0	38.5
6. Go	34.5	17.0	14.0
7. Ho	20.0	23.5	36.5
8. Bu	38.0	37.0	25.5
9. Ne	10.5	12.5	16.0
10. Hi	27.0	37.0	15.0
11. Ta	22.5	12.5	19.0
12. Ho	18.5	21.5	13.5
13. St	11.0	20.0	13.5
14. Fr	12.0	15.0	39.5
15. Ro	20.0	19.5	35.5
16. Bl	17.0	22.0	25.0
Mean	21.47	22.03	23.41
S. D.	8.73	8.01	9.31

BIOGRAPHICAL NOTE

Date of birth: October 26, 1920.

Place of birth: Coquilhatville, Belgian Congo, Africa.

Education: George Washington University, Washington, D. C. September 1939-January 1943, June 1946-July 1947, A.B., Psychology, February 1947.

Carleton College, Northfield, Minnesota. July 1943-March 1944. Army Specialized Training Program, French Foreign Area Study.

Duke University, Durham, N.C. September 1947- .

Positions: Graduate Assistant, George Washington University, February-June 1947.

VA Clinical Psychology Trainee, Durham, N.C., September 1947-September 1950.

Clinical Psychologist, Duke Hospital, Durham, N.C., September 1950-September 1951.

Memberships: Associate, American Psychological Association.

North Carolina Psychological Association.

North Carolina Academy of Science.

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